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EDITORIAL NOTES.

Lessons from Experience for Factory Inspectors.

THERE is encouragement, in the annual report issued last week of the Chief Inspector of Factories and Workshops (Sir Arthur Whitelegge), to the entertaining of more confidence that the divisional inspectors of the department will in time abandon many of their fossilized ideas, adopt the orthodox views of science, and really go to the root of the evil of insanitary atmospheres, and get the root adequately dealt with. Otherwise we shall have the spectacle in these reports—there are already signs of this—of the advanced inspector flatly contradicting the statements of inspectors who are still obsessed by old-fashioned and scientifically dishonoured notions. It is absurd for some few of them to still attack lighting and heating conditions, while others point out that the want of adequate ventilation is at the bottom of all the trouble. We are hoping that the Departmental Committee who, under the chairmanship of Dr. Glazebrook, are considering the question of the lighting of factories, and the protection of the eyesight of persons employed therein, will do something to enlighten those who do the actual inspecting work of the department, and are still behind current knowledge on these particular subjects. There are, however, other subjects in which the inspectors and all employers of labour are, or should be, interested. We all want to see the standard of working conditions raised; and it is a pleasure to find the inspectors have a good word to say for the high standard of conditions to which many gas-works have already attained in the provision of sanitary conveniences—such as baths, proper food storage, mess-rooms, and cooking arrangements for their employees. We believe not only in these things, but in well-lighted factories—factories illuminated by reliable means that are contributory to safety, to the preservation of the eyesight of the workers, and to higher works' efficiency. There is good ground for thinking that among employers there is a steady movement in these directions; though the field is so vast that the "steady "movement" does not seem at the end of a year to have made very much impression upon the conditions existing at the beginning.

Some—not all—of the inspectors still show an unwarranted unfriendliness towards gas, and instead of working to the improvement of the conditions under which gas is used, and putting it to good use for the dual objects of illumination and ventilation, they advise its abandonment, and the substitution of electric light. Complaint is made of the use of flat-flame burners in underground workrooms. In the first place, it is a pity there are underground workrooms; it is a pity that even flat-flame burners cannot be used owing to the execrable ventilating conditions without encountering such condemnation; and it is a still greater pity that those who use flat-flame burners (other than in positions where vibration denies the use of both mantles and the delicate electric metallic filaments) cannot be compelled to take the short inexpensive step to improvement by the substitution of suitable sized incandescent gas-burners. We have one of the inspectors mentioning that he has been much struck by a comparison afforded by three methods of lighting—high-pressure gas, metallic filament lamps, and high-pressure oil-lamps—all of which he said were good, although, he thought, the oil-lamps gave the softest light. If our friend knew of the relative intrinsic brilliancy of lights, he would be aware that as between incandescent gas-lamps and metallic filament lamps there is a great gulf fixed—the intrinsic brilliancy of the latter being so much higher than that of the former and the dangerous infra-red and ultra-violet rays being also predominantly the unhappy possession of the electric incandescent lamp. There is rightly a growing concern among some of the inspectors for the eyesight of the workers in factories; and yet certain of them recommend the metallic filament lamp! While they do this the principal Lady Inspector (Miss A. M. Anderson) speaks of a difficulty. Notwithstanding the very low intrinsic brilliancy of flat-flame burners, and the colour of the flames, she asserts that, in certain quarters where they are used unshaded, work girls complain of the effect on their eyes. If they complain of the effect on their eyes of flat-flame gas-lights, what must they do when electric metallic filament lamps (the intrinsic brilliancy of which is about 150 times greater) are the means of lighting? She also points out that there is a difficulty in procuring proper shades for metallic filament lamps, without incurring a heavy expense, to prevent the glare in the eyes of the operatives; and therefore one finds much makeshift screening among the workers. Yet there are certain inspectors who recommend these metallic filament lamps! Another of the lady inspectors (Miss Meiklejohn) calls attention to a large firm who have adopted indirect electric lighting. But this is found to be very expensive; and in her view a stronger light is requisite. It seems to us that, between the recommendations and experiences, both the factory owners and the workers are likely to be "let-down" by some of the inspectors.

Where, however, the inspectors advise the adoption of electric-lamps in place of gas-lights (instead of recommending the use of improved gas-lamps), the recommendation appears to be due not to any concern for the eyes of the workers, but to a belief that the atmosphere of the workrooms will be improved. We do not find so much in the report this year regarding the carbon dioxide bogey. But we do see signs of the inspectors getting into closer touch with the real trouble of insanitary atmospheres. It is pointed out by Mr. Skinner, of Bristol, that cubic space alone is not sufficient to ensure pure atmosphere. It must be combined with ventilation, without which the air becomes "stagnant" and oppressive. Mr. Crabtree, of Burnley, makes the same point. It has been his experience, when investigating complaints of stuffy atmosphere, that the air samples when analyzed show no excess of carbon dioxide; and he believes that the discomfort felt by the workers is due to the "stagnation" of the air in the rooms. What Mr. Skinner and Mr. Crabtree say is what Dr. Leonard Hill has also been saying the last two or three years. Is the use of the electric light going to cure this condition of air stagnation? Not a bit of it. The electric-lamps do nothing to disturb the passive atmosphere. Gas-lamps do. And experience points to one of the best means of providing ventilation, with which workers cannot tamper, being (for general lighting) gas ventilating-lamps, with a shaft leading out into the open air. Through the energy provided by the heat of these lamps, and the use of local gas-lights, there could be no condition of stagnation, or of such interference with the balance of the chemical composition of the atmosphere, that unhealthy conditions could arise; and we should not then have so much vacuous talk as to the use of gas for this or that purpose giving rise to insanitary atmospheric conditions. It is a question of adequate or inadequate ventilation, and gas can be made to serve the former.

Let us just point the inspectors to two experiences as stated by two of the department's officers which ought to provide some of the objectors to gas with food for reflection. One refers to an extremely effective means of removing fumes from a brass-casting shop in a Belfast factory. All that is done is to provide a large sheet-iron pyramidal hood, with vertical chimney. A 4-inch exhaust-pipe from a gas-engine is led horizontally to the uptake, entering it just above the hood, with a gradual bend upwards. The result is a powerful draught within the hood, which costs nothing to maintain. The idea, it is pointed out in the report, suggests many applications in other industries where gas-engines are in use, and where it is desirable to remove fumes economically, or to improve the general ventilation. Almost precisely what has been done in this Belfast factory is what we suggest to the inspectors should be done on the smaller scale, by the heat from a gas lamp or lamps, in workrooms and factories where a number of employees are engaged, to prevent that stagnation of air to which attention is drawn, and to provide effective and economical means of ventilation which will not set up draughts of which complaint is made by people engaged in sedentary occupations.

It is much better than providing for the ingress and egress of air by means of fans. Most factories and workrooms are in neighbourhoods where the outer air is not uncontaminated by soot and dust and fumes from various industrial operations; and the experience of laundries is that, where fans are employed without elaborate means of air filtration, the soot and dust drawn in by the fans spoil the cleanliness of the work in progress. The other experience in the report to which attention should be drawn as bearing upon the attacks upon gas, and which experience confirms the contention that sanitary atmospheric conditions are all a question of ventilation, is this: During the year an investigation has been made of the air conditions in electric-lamp factories, the processes in which are carried on by the aid of gas-jet machines. Notwithstanding, with good ventilating conditions, the carbon dioxide content of the air was found to be extraordinarily small. Some 75 samples of air were taken for analysis; and 61 of these showed less than 7 parts of carbon dioxide in 10,000 parts of air! Many were as low as 3 to 4 parts; and no sample gave higher than 10·9 parts. When these experiences are pieced together, they point plainly to the path the inspectors should take, and they urge them to allow themselves no longer to be the victims and the tools of traditional fallacies.

Gas-Trading Lines in Germany—and Here.

While the proceedings at the meeting of the German Association reported upon last week were varied, they did not reach the same technical level with which we have been accustomed to associate the conferences of our German friends. The scientific and engineering sides of gas manufacture appear to have been almost neglected; but probably the proximity of the splendid gas exhibition in Munich (impressed with which are the President of the Institution of Gas Engineers, Mr. John Bond, the Junior Vice-President, Mr. A. E. Broadberry, the Honorary Secretary, Mr. W. E. Price, and other *voyageurs* from the British professional ranks) had something to do with the distinct commercial turn and quality of the proceedings. The questions of the cultivation of the gas business, and of the best means of doing it, stood out prominently. The German gas industry has in recent years gone in very strongly for the extension of the application of the utilities of gas; and what has been done through official and individual effort, and through the collective working of the publicity organization of which Herr Lempelius is the moving spirit, is reflected in the remarkable figures that he laid before the members of the Association at the first day's sitting. Think of it, that in Berlin alone (and we fancy this only applies to the area served with gas by the Municipality) the number of consumers last year increased by 60,000. Admittedly, these were nearly all prepayment consumers; but vast establishments are built by stock-size bricks, and but a few years' work of this magnitude from the class of small consumers more than compensates for the electrical patronage of the tenants of larger premises, of whom in Berlin there are only 42,310 as a result of 25 years' trading! Yet with this good showing, we have Mr. Ernst Körting advocating still more intensive publicity work. He believes in the methods whereby big businesses have been, and continue to be, built up. This is not by microscopical advertisement, but by keeping the names of firms and commodities writ large before the public. Substance and a towering position always appear to be behind the large advertisement; behind the small, an attenuated business and rickety finance. For the continuous development of the gas industry, Mr. Körting says that the gas man must force his heating wares to the front, not only for domestic purposes, but for the multitudinous requirements of industry. There is work to be done; and it should be done on the grand scale to get the best of foundations and firm establishment. Our friend is a strong advocate of the claims of gas-fires that give a large proportion of the heat developed in the radiant form, and not the types that are common in Germany of the reflector class, or the kind that gives off such a considerable proportion of its heat in the convected form.

The industry has the goods. Everything points to the extensive development of the heating business depending upon public confidence in the hygienic efficiency of the fires, and in dealing with the exploitation of gaseous heating in a bold manner. Dr. Karl Bunte, at the meeting, pointed to the fact that, with carbon dioxide and water vapour as the products of combustion, gas-fires to-day are quite hygienic; and touching this same hygienic point (in this case in regard to lighting), we have Dr. von Gruber—in describing tests made at the Munich Hygienic Institute, under room conditions resembling as closely as possible those of actual life—stating that, even after gas had been burning in considerable quantities for several hours, no trace of sulphurous acid was to be found in the air of the room, and, with the most sensitive test, they had never succeeded in finding carbon monoxide. Another interesting observation was that, where gas was allowed to burn for long periods, there was no unlimited increase in the carbon dioxide content and temperature of the air, but both quickly reached a stationary maximum—provided, of course, external conditions were not altered. It is quite conceivable that, under given ventilation circumstances such as prevail in an ordinary room, a given maximum is not exceeded, when settled conditions have been reached during lighting hours; and this accounts for the fact that one rarely finds the state of stuffiness that is attained in an electric-lighted room. The fact that a distinct stagnation of the atmosphere is experienced in the case of rooms lighted by electrical means in comparison with rooms, similarly conditioned, lighted by means of gas, can only be ascribed to the dynamic effect of the heat produced by the combustion of the gas—causing, as it does, motion of the air, and thus aiding ventilation. If further proof were required that carbon dioxide in gas-lighted rooms does reach a harmless stationary maximum, it would be found in the fact that, though incandescent gas-burners may be running for several hours without interruption, there is no depreciation of the light-giving power of mantles as there would be with carbon dioxide in excess.

The point about all this is that the gas industry has the means for prosecuting the business of lighting and heating on lines contributing to healthful conditions. There is one consideration about efficiency which is worthy of remark; and it was presented by Dr. Bunte. It is that some system is required for weeding-out the bad gas appliances from the good; and he suggests that gas-fires should be submitted to a test to ensure their being up to a standard approved by the gas industry. We rather think competition, and the ease with which needful tests for hygienic efficiency can be made, as well as the extending adoption in gas-works laboratories of appliances for testing heating values, are in this country doing something to realize precisely that for which Dr. Bunte is seeking. Here, at the same time, the Institution of Gas Engineers has a Committee considering the question of a standard for gas-fires, and the test to be applied. We are hoping for good to issue from the work of this Committee, although from several quarters there have come hints as to the constitution of the Committee not being all that it might be, and should be. The appliances being right, there is the question of further popularizing them. Advertisement will do much, but not all, in this direction. There is the subject of the price of gas; and Herr Göhrum, at the German meeting, advocated a variable scale of charges according to the purpose for which the gas is used. This may be the correct thing in Germany with the higher rates than here for lighting gas; it may even be the thing that we shall have to come to in many places in this country. But the ideal is to get the price of gas down to a flat-rate which will be commercially applicable to all purposes—whether for light, heat, or power. In some places, it would be many years before this ideal could be reached; and there differential gas rates must in time surely obtain, inasmuch as the competitive bases for light, for heat, for power have no uniformity, and there is a broad distinction between the governing factors.

The Gas Industry and Smoke Abatement.

The position—present and potential—of the gas industry in regard to smoke abatement has been opened up, before the Departmental Committee who are considering the subject, by Mr. F. W. Goodenough and Mr. D. Milne Watson; and there are other witnesses to follow from the gas industry. We hope that something impressive in the way of data is being laid before the Committee, to show the members what has already been effected by the gas industry in producing conversion from the use of crude solid fuel to non-smoke-producing practices, and also to indicate to them, through what has already been done, the power possessed by the industry for doing a great deal more. There is, in our report of the evidence of Mr. Goodenough, mention of returns from a large number of gas undertakings; but the

report does not furnish information as to the grand totals of heating appliances in use, which totals we presume are shown by the returns. For the interest of our readers, we should like to have the opportunity of giving from the returns an indication of their information and lessons. Mr. Goodenough will perhaps note this, and act upon it. It is hoped that, when the Committee come to draft their report, they will be able, from the statistical particulars placed before them, to award the gas industry full credit for having done in connection with the subject-matter of the inquiry large and effective work by its own exertions, and unaided by legislation or other influence or support.

The Committee will, of course, be pleased to have for consideration suggestions from all sources as to recommendations that might be made to hasten progress in the work of atmospheric sanitation by the suppression of the principal contributor of pollution. Mr. Goodenough has formulated certain suggestions as to possible means by which the work could be assisted; and it is patent that he believes more in the force of example and provision for the proper installation of non-smoke-producing appliances, than he does in any compulsory action being brought to bear on householders. On the other hand, Mr. Milne Watson thinks the time is ripe for active pressure to be brought to bear upon householders, seeing that gas-fires are almost as good as they can possibly be. Mr. Goodenough would like to see the Government and other public authorities set an example by using gas or coke in public buildings. The setting of an example in this regard means the supersession of custom; and so we may depend upon it that, even though one of the Government departments may be impressed with the fact that there is good work to be done in this matter of smoke prevention, the time is not yet when all Government departments will be prepared to turn from crude heating methods to the more rational ones that the gas industry is doing its utmost, with very fair reward, to encourage.

While not discounting the importance of example, because the industry recognizes it as a great factor in this connection, the second suggestion by Mr. Goodenough is unquestionably more important than the others. It is that, if all property owners and architects would (as some at present do) facilitate by provision of space the installation of gas cooking, warming, and water-heating appliances in all new property erected, and in all old property undergoing reconstruction or renovation, benefit would accrue. There is work to be done among the owners and architects. The question of facilities cannot be too strongly urged; but, in view of the extent of existing property in which no special provision for the purpose in view has been made, the change in this regard would mean very slow work. The local authorities, however, could render assistance, if they chose, by insisting, in their building bye-laws, upon the provision of space for gas-cookers and gas-coppers. Self-interest, however, comes in here. There are few local authorities, we should imagine, without a representative of the building trade in their membership, and consequently there might be very strong opposition to such compulsory insistence upon the proposed provision; and yet builders and architects must be blind if they cannot see that the growing popularity of gas in domestic life renders desirable, and even necessary, such facilities. There must to-day be an immense number, representing an enormous capital expenditure, of coal cooking-ranges and coal-fireplaces that are idle and depreciating through the adoption of gas-cookers and gas-fires.

But Mr. Goodenough, representing the mixed membership of the British Commercial Gas Association, could not say, as he might in another capacity have said, that a further method of helping forward this movement of smoke suppression would be by preventing local authorities owning gas undertakings utilizing the profits in aid of the rates, and insisting upon their employing the money to provide the gas service at the lowest possible price. This ought to be an ambition of civic management that should be a stronger incentive than profit appropriation. There is the question, too, of the Government taking effective steps to ensure that the work of smoke prevention is not largely frustrated by "understand-"ings" among coal-owners as to the price of coal, which understandings have of late years had such a marked effect in diverting money which should have been devoted to reducing gas prices to the community from that purpose to the pockets of the coal-owners.

Elsewhere in our editorial columns, there are references to the hygienic efficiency of modern gas-fires; and in Mr. Milne Watson's evidence, there is a very notable figure, testifying to the appreciation of this form of heating by medical men within the district of the Gas Light and Coke Company. The number of gas-fires fixed in the houses of the medical practitioners of North London is to-day no less than 6000! That is an excellent advertising point. One matter in our report of Mr. Milne Watson's evidence which requires qualification is his statement that his Company calculate that by gas a dinner can be cooked for 3d. That is a very extravagant calculation, unless the dinner is a multi-course one, and for several people.

Co-Partnership in the House.

A perfectly unwarranted attack was made on the Liverpool Gas Company's Bill in the House of Commons last Thursday by Mr. Clynes and Mr. Thorne, whose personal objections to co-partnership, it is obvious, increase with the growth of the beneficent movement. They asked for the rejection of the important Bill in its entirety on the ground that the Company were, through their co-partnership scheme, exercising an undue restriction, and with a rod of iron, on the liberties of their men. But it appeared that these two socialistic members of Parliament were, as it was quite easy for other members of the House to show, speaking without due authority from the employees of the Company. It was not the interests of the employees that they were trying to serve, but those of the trade unions, membership of which is not denied by co-partnership, but membership of which appears to be voluntarily and largely relinquished by co-partnership gas workers. At the base of the opposition is trade union revenue, and not any unjust interference with the men by the boards and officials of co-partnership companies. It would have been a bad precedent had the House rejected the Company's Bill, on the invitation of the two labour members, and upon the false ground of a large discontent among the workers of the Company with the rules and practices relating to the co-partnership scheme. The House was too sensible to take the suggested course.

The Residuals Restriction.

The "Chemical Trade Journal" (which once, and only once sided with our views upon the question of residuals restriction in favour of the chemical manufacturers, and against free trade, and then made a precipitate *volte face*) regards our recent article on the one-third limitation as a "torrent of abuse on the unfortunate chemical manufacturers, and everything appertaining—directly or indirectly—to them." Our contemporary must have been suffering from a deadening of comprehension when it read the article in question; for it was intended mainly as a protest against the violation of the recommendations of the Joint Committee to whom the two Houses of Parliament delegated the duty of advising them as to the correct course to take. We should be sorry to attack the chemical manufacturers upon "everything appertaining—directly or indirectly—to them;" and we repudiate entirely the peculiarly "soft" impeachment as to our capacity for doing anything of the kind. The "Chemical Trade Journal" then proceeds: "Much has been said about these restrictive clauses eliminating healthy competition in the purchase of residual products; but if the gas companies had all their own way, competition, in the exact meaning of the word, would be entirely unknown. Residuals would be sold to the highest bidder, and the gas undertakings could, and would, if necessary, in spite of all the statements to the contrary, subsidize the manufacture of chemical products at the expense of the production of gas itself." Our contemporary ought really to have saved itself from expressing adherence to the extremely foolish notion first voiced by a certain legal luminary.

Spectacles to Transform Artificial Light.—The Chairman of the Research Committee of the American Illuminating Engineering Society (Dr. Herbert E. Ives) has for some time been investigating, as readers may remember, the production of light giving a daylight spectrum, and has recently calculated the actual cost of illuminating a room with artificial light of the same intensity and colour as ordinary daylight. Screens are already employed in certain industries, which are placed in front of incandescent gas or electric lamps; the filtered rays being practically equivalent to daylight. Dr. Ives has suggested the use of coloured glass spectacles, which would screen off the rays which are not required, so that the eye would appear to see only daylight. Different glasses would, however, have to be employed for each kind of illuminant; and this might militate against the adoption of the suggestion.

RETIREMENT OF MR. J. HORSLEY PALMER

FROM THE BOARDS OF THE IMPERIAL CONTINENTAL GAS ASSOCIATION AND THE BRITISH GAS COMPANY.

We are sorry to have to announce that Mr. John Horsley Palmer, who has been a Director of the Imperial Continental Gas Association for the past 39 years, has been obliged, through ill-health, to resign his seat on the Board. He has successively filled, with eminent ability and success, the post of Deputy-Chairman and Chairman of the Association. The latter position, it will be recalled, the state of his health obliged him to relinquish in the early part of last year—at which time his services to the Association were referred to in our pages [see "Journal," March 25, 1913, p. 809].

Mr. Palmer's family have long been connected with the affairs of the Imperial Continental Gas Association. His grandfather, Mr. John Horsley Palmer, was one of the original Directors in 1824, and signed the Deed of Co-partnership in 1826, remaining on the Board for 34 years. His father, Mr. John Carrington Palmer, was a Director for six years (from 1868 to 1874); the united service of the three gentlemen covering a period of 79 years. As those connected with the undertaking, and "Journal" readers generally, are aware, Mr. Horsley Palmer has always taken the greatest possible interest in the Association's affairs; and it is much to be regretted that his great experience and matured knowledge of the business will be no longer available to the Association. The vacancy on the Board has been filled by the election of his son, Mr. Harold G. Palmer.

The same unfortunate reason has necessitated his retirement from the Board of the British Gas Light Company, Limited. His resignation has been accepted with great reluctance and regret, and with the best wishes for a permanent restoration to health. Mr. Horsley Palmer has been a Director of the Company for 33 years, during the last 23 of which he has presided as Chairman. He has promoted the interests of the Company with marked ability; and the friendly interest which he has at all times manifested in the officers of the Company and the members of the staff, of whatever rank, will, we are assured, never be forgotten. The Board have elected Mr. Harold G. Palmer to fill the vacancy; and Sir Corbet Woodall has been unanimously elected Chairman of the Company.

PERSONAL.

Last Saturday, the marriage was solemnized, at the Church of St. Peter and St. Paul, Bromley, Kent, of Mr. Bernard Parker Bezant, the Assistant Engineer of the Dartford Gas Company, with Miss Mary Elizabeth Neale, daughter of Mr. and Mrs. Charles Neale, of Elmfield Park, Bromley. Coincidently with the happy event, the Directors of the Dartford Gas Company, on the recommendation of Mr. F. W. Rapkin, the Engineer and Manager of the Company, increased the salary of their Assistant Engineer by £50 per annum.

At last Friday's meeting of the Southport, Birkdale, and West Lancashire Water Board, Alderman Griffiths, J.P., was presented with a gold key, as a memento of the recent opening of the new pumping-station at the Bickerstaffe Water-Works. In acknowledging the compliment, the veteran Chairman of the Board (who, by the way, has recently had conferred upon him the freedom of the borough) said it was very good, in the closing years of life, to feel that the work which had been given without stint, and with uniform desire for the public weal, received appreciation from those with whom one laboured.

OBITUARY.

The death occurred suddenly, on the 5th inst., at his residence, Flowerfield, Lisburn, of Mr. Edward Stears, who was Manager to the Lisburn Gas Company, Limited, for the long period of 35 years. He retired from this position some seven-and-a-half years ago, and at the time of his death had reached the ripe age of 86. A brother, Mr. John Stears, of Hull—also a former gas manager—died on the previous day, aged 78. Mr. S. M. Stears, a son of Mr. Edward Stears, is connected with the Belfast Corporation Gas-Works.

The death occurred on the 12th ult., in his eightieth year, of Mr. Thomas Dolan, the Chairman of the United Gas Improvement Company of Philadelphia (Pa.). He was elected a Director on June 5, 1882, and President on Feb. 26, 1892. At that time the gas-works of the city were in the hands of the Municipality, who carried them on at a loss of $400,000 a year. Five years later they were taken on lease by the Company, who successfully developed the business, so that last year they received a revenue of nearly $2,000,000, in addition to supplying free gas to the public buildings and the street-lamps. Mr. Dolan resigned the presidency on March 16, 1912, on account of advancing years and failing health, and was elected Chairman. At a special meeting held on the 18th ult., the Board expressed in resolution their profound grief at the loss they had sustained.

ELECTRICITY SUPPLY MEMORANDA.

We know very well from large experience in different quarters that—taking all expenses into consideration, the unrestricted consumption, and the demand coming on the peak of the load—systems of fixed low prices for electric lighting cottages do not pay electricity supply undertakings. But there is in the system an attraction for some poor householders in the idea of being able, without additional cost, to run lamps as long as their inclination prompts. One worthy representative of a municipal supply concern in a mining area was saying the other day that the experience of fixed prices for electric lamps among the miners was that at dusk up went the lights, and, whether or not the rooms were in use, the lights were running the evening through, and sometimes the people did not trouble to switch them off until they awoke next morning. Such free, wasteful use is one attraction. But there is another. The writer came across a case of a poor woman living in a flat where, under a fixed price system, she is supplied with three miserable lights for 6d. a week, which is a lower sum than she used to place in the slot of her prepayment gas-meter per week. So she affirmed that electric lighting for her is cheaper than gas—at any rate, during the winter when she wants more light. On investigation, it was found she still uses a gas-cooker and the slot gas-meter, and that the difference between the amount of coin she now puts in the meter for cooking and hot water provision in the dark months of the year compared with formerly is about 3d. per week. It had never occurred to her that the *difference* between what she is now paying for gas and formerly is the sum to compare with what she is paying under the fixed price system for electric lighting. She had to confess, too, that the light from the incandescent gas-burner she previously used was better than that from any one of the electric lamps now supplied to her; but she thought the electric lamps gave her a better light than two flat-flame burners that were formerly in use. Gas undertakings would not be doing themselves any injury by gradually working-out flat-flame burners from the houses of prepayment meter users.

A Small Householder's Error.

Mr. A. H. Dykes, whose name will be recognized as having been concerned in certain cases where gas companies have gone into the combined business of gas and electricity suppliers, is interested in the fixed-price system of charging small householders for electric light. Speaking at the recent meeting of the Incorporated Municipal Electrical Association, he stated that the poor man at present paid more for gas and oil than he could afford; and there must be something wrong if he could not be supplied with electricity at a suitable rate. We have in the preceding paragraph a case in point, in which a poor woman pays more under her combined gas-electric scheme than she formerly did for gas alone, including two wasteful flat-flame burners. But Mr. Dykes went on to say that at Wimbledon, the Electrical Engineer (Mr. Tomlinson Lee) had 2000 houses, which were previously using penny-in-the-slot meters, now equipped with the electric light—some 5000 lamps; and the increase of revenue to the Electricity Department was more than £1000 a year. Does Mr. Dykes mean to say that the department realizes from each of these houses an average of only 10s. a year in revenue? If so, does it really pay the department, or do the other consumers or the rates have to bear the loss? The statement as framed by Mr. Dykes suggests that the 2000 houses have had their prepayment gas-meters removed; but we do not believe he would be able to point to a single meter that has been disconnected because of the fixed price electric lamps having been installed. There are within our knowledge a couple of roads that were dealt with on the fixed-price system before last winter; and of the 149 houses in these two roads, 140 are to-day supplied with gas through prepayment meters—the average consumption for all purposes last March quarter averaging out at 5100 cubic feet, which is about the usual for the time of the year for the occupiers of such houses who use gas for all kitchen purposes, and for room lighting generally. The fact that they consume little or no gas in the summer time for lighting makes little difference to their gas accounts. In the district in mind, the latest types of inverted incandescent gas-burners are being supplied to the prepayment consumers; and when there is a change of tenancy, the tenant usually prefers incandescent gas lights throughout his premises. He has only to switch on the electric lamps to show him which light gives him best service for the money he has to expend. The electric wiring of the houses in question is of a very flimsy character, and will have to be renewed after a very few years. The more we look into this question, the more hardened becomes the view that gas undertakings have nothing to fear from this crude method of supplying electricity without measurement—if gas undertakings will only see to it that the prepayment consumers are given facilities for having the most modern forms of burners.

Dykes' Experience and that of Other People.

In dealing last week with the proceedings at the meeting of the Incorporated Municipal Electrical Association, it was intimated that there were a few other points of interest to which attention might be drawn in the "Memoranda." The electric cooking question did not receive much consideration

Suggested Cooking and Heating Census.

at the meeting; and water heating by electricity had only incidental reference—indeed, it was, as was appropriate, left almost completely out in the cold. We may preface the points gathered from the meeting, by remarking that, in the "Electrical Times" since the meeting, a proposal has been made that electrical engineers should assist our contemporary in making a census of the number of electric cookers and radiators that have been fixed. It is assumed that the aggregate of the cookers cannot fall far short of 20,000, while heaters must be numbered by hundreds of thousands. It would be interesting if our contemporary could extend the particulars, so as to allow discrimination to be made between cooking outfits which are used to the total exclusion of all other means of baking, boiling, and water-heating for kitchen use, and cooking outfits which are supplemented by other means of doing the work. It would also be very interesting if, under the head of cooking apparatus, it would discriminate between ovens and small apparatus such as bacon-warmers and egg-boilers, so that proper knowledge might be obtained as to what is meant by "cooking apparatus." It would not be a bad thing, too, to give the names of the towns or districts alongside the figures applying to them. When we consider the splash over electric cooking that has been made at various electrical exhibitions, and the extraordinary effort that has been put into the cultivation of the business, we must confess, looking at the figures of which the gas industry can boast, and shutting our eyes to the restoration of gas-cookers in certain houses within our ken in which electric-cookers had been placed, we are amazed that the "Electrical Times" is able—in view of the number of faddists there are even in matter-of-fact Great Britain, and the number of people who are engaged in the electrical industry—to only pitch the number of cooking outfits fixed at 20,000.

Non-Paying Hiring.

Turning to the proceedings at the meeting of the Municipal Electrical Association, we see that Mr. Vignoles confessed that, at 1d. per unit, the inhabitants of Grimsby had shown their great appreciation of heating and cooking by contributing the following massive sums to his revenue during the past three years: £206, £214, and £324. What he finds is a disadvantage is that the only suitable apparatus for cooking purposes is too expensive for small consumers to buy; and it is difficult to get consumers to pay 15s. a quarter for electric cooking apparatus when they can hire a gas cooker for 3s. 6d. Just so! And many gas undertakings charge less than that, and some lend them free—making their profit out of the charge for gas at lighting rates. Of course, Mr. J. H. Bowden, hailing from the anything but aristocratic neighbourhood of Poplar, thinks that £3 a year is too much for a hiring charge for a cooker. His opinion is that 5s. is quite enough; and he states that he is getting a cooker suitable for Poplar at £6 or £7. It must be a poor sort of thing. If Mr. Bowden's 5s. hire applies to a quarter, it would mean that replacement, interest, and repairs would be paid for in about ten or twelve years, without any charge for the frequent inspection that Marylebone finds so imperative. If he means 5s. a year, his successors in office would see his outgoings back, if the cookers would last sufficiently long, about which from present experiences we have our doubts. Accompanying a low rental, he also proposes to supply current at a low rate; so where his profits are coming from nobody, not even Mr. Bowden, can know. We see that in opulent Marylebone, Mr. A. H. Seabrook admits to having only 769 cooking apparatus on hire; and we have our suspicions that he includes in this figure everything in the cooking line—down to an egg-boiler—his complete cooking outfits numbering only about 250. His increase in general cooking appliances last year only amounted to 149. Marylebone is an outstanding district; and if nothing better can be done there as the result of years of strenuous labour, well then districts with less affluent populations cannot hope to improve on the experience. What does Mr. Seabrook acknowledge about this hiring business? That in the first year the cost of hire against revenue showed a "considerable loss;" in the second year a small loss; in the third year a slight loss; now the hire receipts are covering the whole of the maintenance, inspection, and administration costs, leaving "something" over for depreciation and interest. There is a want of confidence in Mr. Seabrook's remark that "no doubt, in a year or two, they would be able to cover the interest, and have something to spare for depreciation." In view of the price charged for current, this does not look very hopeful for a profitable cooking business in other districts. The point had better be noted by the opponents of the Municipal Electrical Association's Hiring and Wiring Bill; and if this measure ever passes, they must see that, before it does so, the ratepayers are fully protected against the speculative business.

Other Difficulties and Other Points.

An expensive matter, too, in connection with electric cooking apparatus has been the cost of inspection. Mr. Seabrook says that, with electric cooking, the trouble has been the necessity for close inspection (we know this has been so not only in Marylebone, but elsewhere). Mr. J. Christie, of Brighton, pointed to another difficulty. He has an enormous number of consumers whose wiring is absolutely unsuitable for any other kind of work. Therefore, the Brighton Electricity Department has to be chary about pushing other uses of electricity, because it means that, in every one of these cases, the houses would have to be rewired. With the smaller table appliances, there is also trouble with flexibles. Mr. Seabrook called attention to this point. The flexibles are inconvenient—they get in the way, and are frequently damaged. The "Electrical Times" refers to this as "becoming quite a serious matter." The "flex." is in most cases taken from a wall socket, and is carried over the carpet to the table. It is subjected to all kinds of maltreatment—being trodden upon, kicked, and pulled, while chairs and furniture are often placed on it, or moved over it. No self-respecting flexible will stand ill-treatment of this kind. Cab-tyre flexible is offered as a solution; but the unsightliness of it! Our Sheffield friends might notice, in connection with the general subject of cooking, that Mr. Fedden, the Electrical Engineer of the city, says he has instituted a plan of charging ½d. per unit for electricity used for heating in the case of restaurants which do all their cooking by electricity. Some of the hotel and restaurant proprietors have, he says, sent their cooks up to London to look into the matter, with the result that they have lately given orders for *complete equipments*. Poor fellows! How easy it is in these days for some people to be sucked in.

Water Heating.

Very little was said at the meeting regarding the subject of water heating by electricity. Mr. Seabrook, however, repeated what was said recently by his faithful henchman Holmes [see "Memoranda" for June 30]. It was to the effect that with electric water-heaters, fitted with thermostats, and current at ½d. per unit, electricity can for water-heating compete with gas at 2s. 6d. per 1000 cubic feet. We asked Mr. Holmes a few questions on the subject, and that worthy has not deigned to reply. We now ask Mr. Seabrook to tell us the types and capacities of the two classes of hot-water apparatus with which he makes comparison; also whether he is prepared to supply, starting cold, as many 20 or 25 gallon baths of water in a couple of hours from one apparatus, at the same price and at the same temperature as by means of gas. In electric water-heating (says Mr. Seabrook) 95 to 98 per cent. of the heat units in electricity can be utilized, whereas in the "*best* gas apparatus," one cannot get a heat efficiency above 35 to 40 per cent. Mr. Seabrook must know that figures such as these do not refer to all apparatus. The figures 95 to 98 per cent. are not true, for instance, with kettles on heating elements, nor with water into a bath or other utensil from an electric water heating and circulating apparatus. The 35 to 40 per cent. in connection with gas is not true, except for a wasteful open-ring gas-burner, with a common kettle over the top, which does not cover the whole heating field of the flame. The figures do not apply to properly fitted gas-geysers, water-circulating boilers, and other apparatus of the best constructed types. To say that they do (as was in effect said by Mr. Seabrook when he referred, according to one report, to the "best gas apparatus"), is to say something that is quite untrue; and one in Mr. Seabrook's position ought to be above even indirect misrepresentation regarding an opponent. It is bad enough to find this sort of thing in a canvasser working on commission; and when he is found employing such deception he ought to be summarily dismissed. Mr. Bowden, in this matter, was more rational and truthful. He stated that he had still to be convinced that electricity could heat water satisfactorily. "It was no use trying to convince people that they could get something out of nothing." Mr. Lloyd George, fluent as he is, has not convinced the intelligence of Great Britain, nor even the multitudinous obscure whom he has sworn to benefit, that they are under the National Insurance Act getting ninepence for fourpence.

Objection to Candle-Power Markings.

It would be interesting to know from the Council of the Incorporated Municipal Electrical Association why they object to the markings of metallic filament lamps including both watts and candle-power. Is it that they know, as we know from a long series of tests of many kinds of lamps, that the wattage of metallic filament lamps even in the same groups has been found to wander from 1·25 to about 1·7 per candle, and that there are very few of such lamps that give the candle power ascribed to them, even under the pressure regulated conditions of the photometer-room? In the absence of any other explanation, we think that this variation between actuality and marking is the reason for the objection of the Municipal Electrical Association, although to us it seems much better that a lamp which runs under fixed conditions should be known by its duty rather than by its consumption. Evidently electricity suppliers prefer to mask the variable candle power of the lamps behind the wattage. The Association, in wishing watt-marking only, have found themselves in direct opposition to the War Office, the Admiralty, the Post Office, and the Public Works Department. The Tungsten Lamp Association subsequently informed the Municipal Electrical Association that, by a majority of votes, they had decided to adopt the dual marking of candle power and watts—the majority being obtained by the votes of representatives of public departments. It has dawned upon the Council of the Municipal Electrical Association that the interests of the Government Departments do not harmonize with those of the public electric supply authorities. There should be a little piquant interest attaching to this statement, because we conceive that the interests of the Government Departments are the interests of the general public, though not of the electricity supply authorities. There is something behind the objection to candle-power markings; and this "something" is

no doubt the gross deception of such markings. The Council of the Municipal Electrical Association and the lamp makers are in agreement as to wattage rating; but there seems to be among them some regret that a specification is not likely to be issued by the Engineering Standards Committee which will be acceptable, "unless the contemplated rearrangement of the Standards Committee results in a considerable change in its constitution." In other words when one cannot get what one wants from a specially constituted tribunal, then change its composition.

NOTES FROM WESTMINSTER.

Two or three points of interest arising from Committee work last week may be mentioned.

The Calorific Power Standard.

The Bill of the Gaslight and Coke Company, which contains what is now regarded as the standard form of calorific clause—except in respect of the figures representing the standard and the penalties—was threatened with opposition from the local authority of East Ham, and the Bill was actually put down for an appearance before a House of Commons Select Committee last Tuesday. It was then listed for Wednesday; and finally it was transferred to the attention of the Unopposed Bills Committee—the East Ham authority withdrawing their opposition. With the London County Council, the City Corporation, and the numerous councils in North London and beyond all satisfied, the singularity of East Ham was a little bit amusing; and no doubt the most amiable method of retreating from an untenable position was adopted when their isolation as opponents, and its meaning, were fully demonstrated to them.

High-Pressure Meter Testing.

The high-pressure meter testing clauses included in Bills promoted by the City Corporation and the London County Council (the text of which appeared last week in our "Parliamentary Intelligence," and comment upon which was made in the editorial columns), have been before the Local Legislation Committee. The clauses, as mentioned a week ago, had been agreed with the London Gas Companies, so that there was no opposition, and only justification for the clauses had to be shown. This was not a matter of great difficulty; and with Mr. R. S. Hilton, the Secretary and General Manager of the Birmingham Corporation Gas Department, able to say that similar clauses had been satisfactorily at work for a few years in Birmingham, the Committee had little inquiry to make to convince them of the utility of the provisions. Bearing, however, upon our contention that, instead of there being legislation solely for London, the matter should have been deferred until the Board of Trade were able to take up the whole question of the amendment of the legislation affecting gas-meter testing, we find that these clauses in the London Bills may have merely temporary effect; seeing that there appears a provision which rather foreshadows—when? is a doubtful matter—the Board of Trade some day moving for general legislation. Says the provision: "Nothing in this part of this Act shall confer any exemption from the provisions of any General Act relating to high-pressure meters which may be passed in any future session of Parliament."

New Road Construction and Pipe Accommodation.

The Brentford Gas Company have not gained what they set out to secure, and persistently fought for, in connection with the construction by the Middlesex County Council of the new western road out of London. The road, as will be remembered by the statement made when the Bill was before the House of Commons Committee, is an exceptional one in the strength of its concrete foundations, in order that a good even surface may be maintained; and the County Council do not want the surface to be disturbed by pipes and wires being accommodated under it. All pipes and wires are therefore to be located under the footpaths; and all the Brentford Company were out to obtain was ample provision for their future needs under the footpaths (the provision that is being made, they contended, is inadequate), and to be permitted to lay cross pipes of ample size under the roads, in place of accommodation in subways. The matter has again been contested before the Duke of Bedford's Committee; but in the result the position has not altered since we last referred to it. The Committee passed the County Council's scheme, and would not accept the clauses proposed by the Gas Company. The decision has been arrived at despite expert evidence as to the extremely doubtful adequacy of the accommodation provided under the footpaths, and as to solid bedding for pipes under cross roads being better than subways. The Gas Companies' Protection Association, too, were denied an appearance before the Committee, notwithstanding that a new order of things is proposed here in road construction in relation to the accommodation of public services. The road surface is not the only matter to be considered from the public point of view; the public being also interested in the sufficiency of the accommodation for the other services necessary to their daily life. The matter has become one of general importance, and is not limited to the convenience of the Brentford Gas Company in regard to this particular road.

OPENING OF MODEL ROOMS AT EDINBURGH.

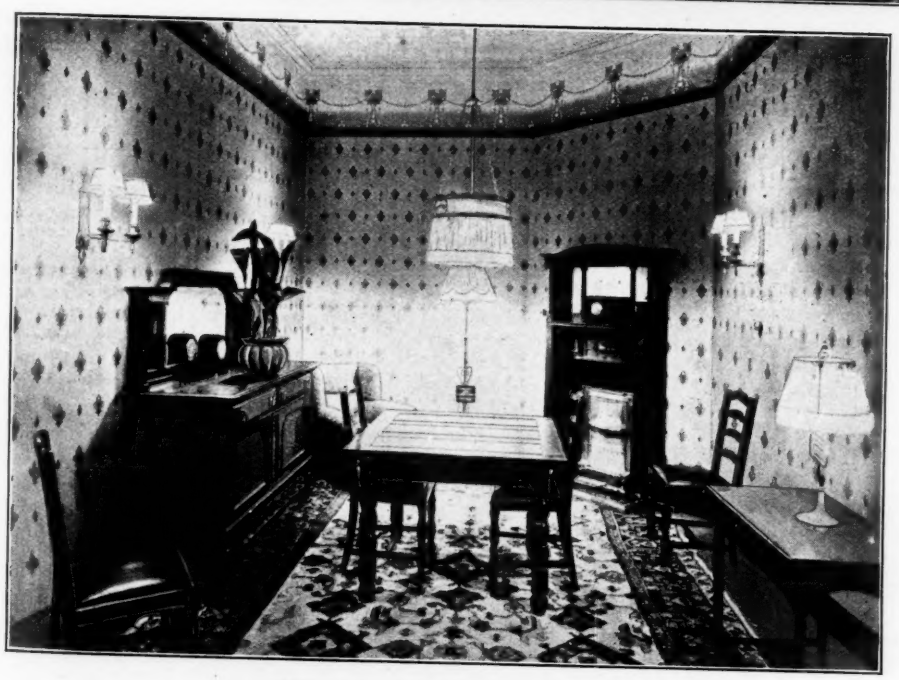
[See Illustrations pp. 87-88.]

THE Edinburgh and Leith Gas Commissioners invited a number of representatives of the Press to view the new rooms which they have fitted up in their offices, to show what can be done with gas as an illuminant and a heating and cooking agent. The arrangement provides a reception hall, drawing-room, dining-room, bedroom, kitchen, and bath-room, where all that is latest and best in gas appliances has been used, even to such minor matters as the heating of curling-tongs and the lighting of a cigar. The reception hall serves also as a show-room for a number of gas-cookers and apparatus connected therewith, any of which, it may be pointed out, can be immediately connected to the gas supply for demonstration purposes.

The hall is lighted by a patent ventilating lamp which carries the warm air and products of combustion through special tubes to the outside of the building. Here also are two semi-indirect bowl-shaped fittings with concealed lights. The drawing-room is of "Adam" design; and in it is fixed an armour bright "Renaissance" gas-fire, of the Richmond make, fitted with pneumatic lighter, so that it can be switched off and on at will. For lighting, a three-light pendant is fixed in the centre of the room, and three two-light brackets on the wall—all controlled by means of "Telephos" pushes. A standard floor-lamp and table-lamp are connected to the gas supply by a flexible tube attached to plugs in the floor, so that the screwing round of the top portion of the plug turns the gas off, and reversing the motion turns it on. In the bedroom a two-light adjustable pendant is fixed over the dressing-table, again worked by "Telephos" attachments; while a bracket near the bed is connected by a pear-shaped push. Here also is fixed a "Sola" gas-fire (Wilsons and Mathiesons, Limited), with a push for its ignition from the side of the bed and from the door. The comfort of this is great, as on awakening one can heat-up the room while thinking about rising. Pneumatic pushes have been used in the dining-room, and candle fittings with "Telephos" lighters. Here a "Times" gas-fire (John Wright and Co.) is also provided with a self-lighter attachment. In the bath-room a geyser is fitted so that the turning-on of the water automatically controls the gas supply, and no gas is burned except when water is flowing. The wash-hand basin has an instantaneous water-heater for washing, shaving, or other purposes. A towel-rail, heated by gas, acts not only as a towel-airer, but also assists in the warming of the bath-room; while a "Durham" gas radiator is fitted as an alternative. The kitchen hot-water circulator is also connected to the hot-water system in the bath-room. In the kitchen is a "Main" combination gas-range with a large roasting and baking oven at a good height, and alongside it a hot-plate and grill, with a small gas-fire for heating the kitchen. Under the hot-plate is a gas circulator provided with a thermostat. An "Express" water-heater is fitted at the sink. A small wash-boiler is shown, and parabolic reflectors on the pendant near the gas-range throw the light where it is most required. A gas-iron is also provided on the kitchen table.

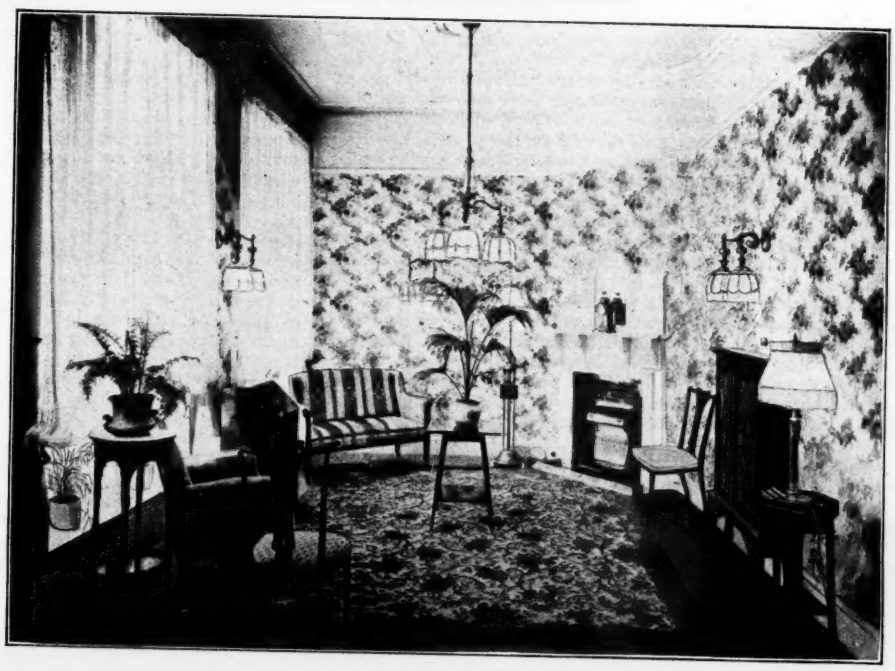
After the examination of the model rooms, Bailie Lindsay, the Convener of the Works Committee, explained the reasons for the Commissioners undertaking the scheme. He said it was necessary owing to the decline in the consumption of gas up to 1912, which clearly indicated that they would have to find a wider field for its use if they wished to keep the output on the increase. They had had reports from the Consulting Engineer (Mr. W. R. Herring, M.Inst.C.E.), the Engineer and Manager (Mr. A. Masterton), and the Treasurer (Mr. Canning Williams), and after adopting the proposals of these gentlemen they had found a much improved state of affairs, which clearly indicated the value of the reports. In 1911-12 the quantity of gas sold was 1,885,228,400 cubic feet, while for the year just closed (1913-14) it was upwards of 2000 million cubic feet, or an increase of more than 134 millions for two years. On making inquiry, they found that throughout the country the larger gas-supplying authorities had installed show-rooms. The Commissioners considered it necessary to follow this lead; and they decided to fit up suitable exhibition rooms at their own offices. He was sure this would prove of interest to the public generally, and lead to the more extended use of gas in the household. Bailie Lindsay also referred to the circumstance that the North British Railway Company had installed high-pressure gas at their goods yards at South Leith and also at Portobello, and that so much satisfaction had been given by the system that they were going to adopt it both at Dunfermline and at Hawick. In view of the fact that the Company were consumers of from 15 million to 20 million cubic feet of gas annually, it could be understood that the Gas Commissioners desired to retain so good a customer, and that they were highly pleased that the system was giving so much satisfaction. Mr. Masterton, in the course of a few remarks, pointed out that all the work, with the exception of the joiner and decorative portion, had been carried out by the Commissioners' own staff, and that it was proposed to vary, from time to time, the fittings in the different rooms, so that the public could see all that was best and newest in gas apparatus. He also acknowledged the great help he had received from the Chief Engineering Assistant, Mr. H. H. Gracie, and other members of the staff. It was, he said, hoped that the additional facilities would be appreciated by the citizens, and would be reflected in enhanced revenue to the Gas Commission.

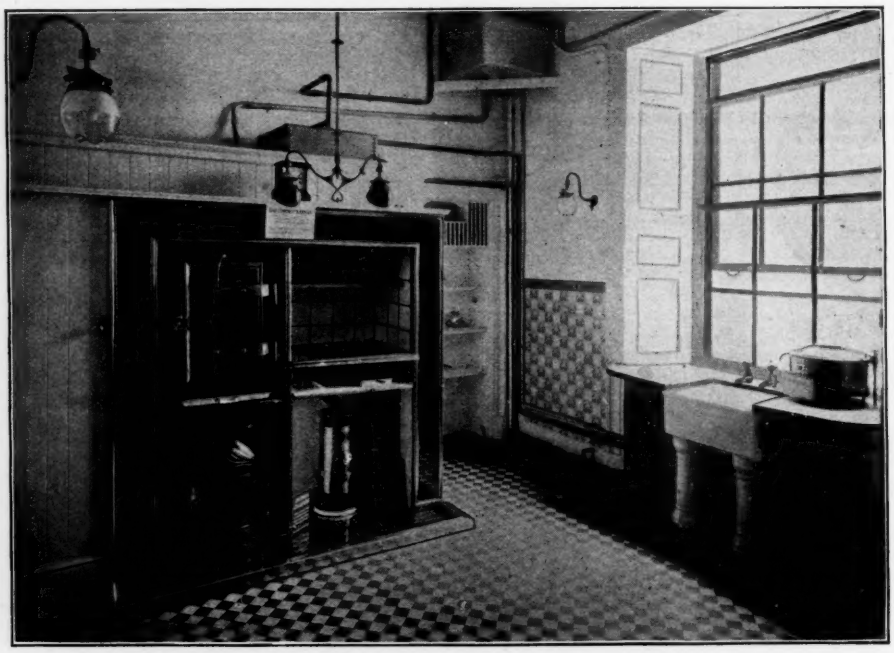
THE RECEPTION HALL.



THE DINING ROOM.

THE DRAWING ROOM.





THE GAS-FITTED KITCHEN.

INSPECTION OF FACTORIES AND WORKSHOPS.

Chief Inspector's Annual Report.

THE Annual Report of the Chief Inspector of Factories and Workshops (Sir B. Arthur Whitelegge, M.D.) was issued last week. It is followed by a divisional report, signed by Mr. Gerald Bellhouse, the Superintending Inspector of Factories, and Mr. W. Sydney Smith, the Inspector for Dangerous Trades, as well as by the reports of the Principal Lady Inspector (Miss A. M. Anderson), the Medical Inspector (Dr. T. M. Legge), and the Electrical Inspector (Mr. G. Scott Ram). The following are the portions of the report of special interest to "JOURNAL" readers.

OBSERVATIONS BY THE CHIEF INSPECTOR.

In opening his report, the Chief Inspector points out that the arrangement of the various reports for the past year differs somewhat from that adopted in their predecessors. In place of separate detailed reports by the six Superintending Inspectors and the Inspectors for Dangerous Trades and Textile Particulars, a comprehensive report has been prepared by the Senior Superintending Inspector, and, so far as regards matters within his province, by the Inspector for Dangerous Trades, covering the same ground more adequately and with less repetition. This, with the separate reports of the Medical Inspector and Principal Lady Inspector, renders unnecessary the summary which in recent years was prefixed. It is hoped in next year's report to carry the alteration farther, by dividing the general report into chapters.

There was no important legislation concerning the Factory Department in 1913. A Committee was appointed, with Dr. Glazebrook, C.B., F.R.S., as Chairman, "to inquire and report as to the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, the protection of the eyesight of the persons employed, and the various forms of illumination." Formal investigation was made, on behalf of the Secretary of State, by Mr. A. G. Drury, M.Inst.C.E., the Engineering Inspector of the Local Government Board, with regard to the explosion of a gasholder at Ilkeston. His report made certain recommendations which were brought to the notice of the authorities concerned.*

Apart from the work of Committees and Commissioners, a number of special inquiries were completed or undertaken last year. One of them was on an explosion of a Diesel engine, on which Mr. G. S. Taylor presented a report. In connection with dust explosions in factories, Dr. Wheeler reported in March the results of further experiments with regard to the inflammability of carbonaceous dusts and their capacity for the transmission of explosions.

During the past year the staff was increased by twelve, raising the total to 217. The general administrative work of the several branches of the Department is fully recorded in the reports appended to that of the Chief Inspector; and the usual statistics are supplied by the tables at the end of the volume. One of these shows that at the end of the year there were nearly 300,000 works under inspection, including 120,000 factories and 154,000 workshops, in addition to docks, wharves and quays, warehouses, and buildings in course of construction. Factories increased by nearly 13,000, while workshops were nearly 2000 fewer than in 1912. According to the latest completed returns (for 1907), the total number of persons employed in factories was 4,488,774, and in workshops 638,335. Some 425,000 effective visits of inspection were made, and nearly 200,000 cautionary notices were issued. Prosecutions were instituted in 3872 instances, against 2674 in 1912. Fatal accidents increased from 1260 to 1309, and other accidents from 154,972 to 176,852. Details of these are given. The accident returns correspond generally, as in former years, with the recorded activity of trade, especially in the branches in which the risk of accident is greatest.

EXTRACTS FROM THE DIVISIONAL REPORT.

Sanitation.—Mr. Elton (N.W. London) mentions a gas-works in which a fully equipped bath-room and cloak-room are provided, together with lockers for food and for clothing put off during working hours. In the Northern Division special mention is made of a growing tendency to provide washing conveniences, particularly in food factories, and also baths. Mr. Wilson (Glasgow) has found bath accommodation in several small country gas-works. In the larger gas-works most elaborate provision has been, and is being, made. Mr. Franklin (Aberdeen) comments on the admirable arrangements in two works in Aberdeen and Fraserburgh respectively, and Mr. White (Gloucester) on the provision of baths for stokers at gas-works in his district.

Lighting.—The investigations by the Departmental Committee already referred to are still in progress, and this subject must therefore be regarded as being to some extent *sub judice*. While it has not been possible on this account for Inspectors to take any active steps, the question has not been entirely lost sight of. It formed one of the subjects of discussion at the Ironfoundries Conference, where proposals were put forward for standardizing both natural and artificial lighting. As regards the former, it was suggested that there ought to be some minimum relation between window and floor area, and a proportion of 1 : 4 was proposed. A special investigation into the artificial lighting of foundries had been carried out by Mr. D. R. Wilson, and a memorandum giving the results of his inquiries was published in last year's report.* It seemed possible from the data collected to draw a fairly clear line between efficient and non-efficient lighting; and his conclusions were therefore embodied in the proposal that no foundry should be deemed to be adequately lighted unless the illumination intensity, measured on a horizontal plane 1 foot above the floor level, did not fall below 0·3 to 0·4 foot-candle over any part in which work was being carried on, or over which any person was liable to pass. This proposal was discussed at considerable length; but consideration of it was ultimately postponed until the second meeting of the conference.

Meanwhile, the announcement was made of the appointment of the Departmental Committee, and the employers at the second meeting intimated that, though the question had been carefully considered, they thought it inadvisable to continue the discussion in view of the wider investigation that would be undertaken by the Committee. Consequently, no definite results were arrived at. At the same time there was a general agreement among those

* The report was given in the "JOURNAL" for March 25, 1913 (p. 814).

* See "JOURNAL," Vol. CXXIII., p. 47.

present as to the importance of good lighting. It is important from three points of view—the first being that of safety. It is well-nigh impossible to produce statistics to show the effect of lighting on the accident rate; but the proposition that a well-lighted foundry is a safer place to work in than a badly-lighted one was generally accepted at the conference. Secondly, as regards output. It could hardly be disputed that more and better work is produced under good lighting conditions, and the following quotation of a statement by Mr. H. J. Wilson (Glasgow) is pertinent to this aspect of the case:

> There is no doubt whatever that a highly intelligent interest is being taken in the improved lighting of industrial premises. I am always told that improvement in lighting pays the manufacturer; and as this becomes recognized, little encouragement is necessary to persuade employers to adopt an efficient system of illumination. Two large shipbuilding firms have entirely remodelled their lighting, at considerable cost, both for inside and outside work.

Finally, as regards its effect upon the comfort and eyesight of the workers—and it is on this point that guidance is perhaps most needed from the Committee—one startling case (brought forward by Mr. Solloway, of Manchester) is quoted by Mr. Jackson:

> A particularly bad case of apparent eye-strain through defective lighting was noticed in a cotton reeling workshop. This was partly underground, and had windows on one side only. Except on very bright days, gas was used for lighting nearly continuously; and exactly 50 per cent. of the workers employed on the row of frames farthest from the window wore glasses, while on the row nearest the window only 5 per cent. wore them. The occupier treated the fact as a mere coincidence; but it appeared a possible case of cause and effect.

This case was brought to the notice of the Lighting Committee.

Temperature.—A notable feature of the complaints received in the South-Eastern Division was the number relating to cold work-rooms; and much time had to be devoted to this subject. Mr. Parkes (North London) had some difficulty with the City basement workshops. The Insurance Companies either prohibit the use of coal-fires, or else fix prohibitive premiums; while in many basements there are no chimneys at all, and there are obvious difficulties in carrying a ventilating flue from a stove through the upper floors or out at the street level. At present the occupier falls back too frequently upon the flueless gas-stove, often on the advice of the gas companies who provide them. All Inspectors have had much difficulty in dealing with stoves of this kind; and though many have been superseded, there seems to be an ever-recurring supply of new installations which require attention. Mr. Verney (N.W. London) has found the use of gas-lighting burners for warming purposes to be fairly common; but this no longer seems to be the general experience. A marked advance has been achieved in the heating of large engineering shops. "The old style of heating by coke-fires," says Mr. Jackson (N.W. Division), "appears at last to be giving way to more modern methods. Several firms have already installed either hot air, steam, or hot water systems of a satisfactory kind; and others have the matter in hand."

Ventilation.—Special investigation was made during the year of the air conditions in electric lamp factories, all the processes in connection with which are carried on by the aid of gas-jet machines. A high standard of ventilation is, therefore, essential. The subject is dealt with at length in a report from Mr. Pedlar, who undertook the inquiry in the South-Eastern Division, where the majority of works of this kind are situated. The results obtained were most satisfactory, and the proportions of carbon dioxide in the air were extraordinarily small. Some 75 samples of air were taken for analysis, and 61 of them showed less than 7 parts of CO_2 per 10,000 parts of air; while many were as low as 3 to 4 parts. Only five were above 8, and no sample gave a higher reading than 10·9. These returns, it is pointed out, bear ample testimony to the efficiency of the fans and ventilating arrangements.

Gas Explosions.—Mr. Davis (Kent) draws attention to a danger found to exist in the water-gas plants of a town gas-works, which gave rise to an explosion attended with fatal results. The danger is due to the fact that a rise of pressure above the normal on the generator side will cause a rush of gas into the blast-ducts when the blast-valve is opened, forming an explosive mixture which may be ignited by the hot generator. Attention is now being given to this point by gas-plant makers, and improvements have already been made in the means for preventing such occurrences. Several new plants fitted with efficient safety appliances have been seen.

Mr. Hilditch (Swansea) reports on an explosion in the testing-house at the Milford Haven Gas-Works, by which five persons, including the Manager, were injured. A torch lamp was burning in the house, in which the men were at work connecting the gas-pipes to a new purifier-house. The explosion appears to have been due to the opening of a control-valve, which allowed the gas from a holder to flow back into the line of piping under construction, and the gas was fired by the naked torch. The lesson provided by previous serious gas explosions at Coventry, Birmingham, and elsewhere, had not been learnt; but proper safety lamps will be used in future.

A fatal explosion occurred near Edinburgh in connection with the dismantling of an old gasholder. Owing to its leaky condition, the holder contained a mixture of air and coal gas, and as the manhole bolts were so rusted as to be immovable, it became necessary to cut a hole in the top of the holder to allow the gas to escape. The usual method of discharging gas from a holder consists in opening the manhole on the top plating. Though some precautions were taken to prevent sparking of the cutting-tool, a spark was produced, and this fired the gaseous mixture within the holder. Similar explosions have been recorded when cutting holes in the plates of gasholders with chisels; and it is advisable to use instead some corrosive acid to dissolve a portion of the plate enclosed within a ring of clay.

Dangerous Trades.—During last year two codes of regulations, superseding special rules, came into force. In the Northern Division many of the brass-casting shops are exempt from the regulations by reason of their large cubical space, coupled with good ventilation. But where the code applies the fumes have generally been dealt with satisfactorily by means of exhaust ventilation. Mr. Scott (Belfast) has noted the following ingenious method for dealing with the point: "Over the casting part of the foundry is placed a large sheet-iron pyramidal hood with a vertical chimney, 10 inches in diameter, leading through the roof. The 4-inch exhaust-pipe from the gas-engine driving the lathes and machinery, is led horizontally to the uptake chimney, and enters it just above the hood, with a gradual bend vertically upwards. The result is a powerful draught within the hood, which costs nothing to maintain. The idea suggests many applications in other industries where gas-engines are installed, and where it is desirable to remove fumes economically or to improve the general ventilation."

Patent Fuel.—In view of the agreements at the conferences between inspectors, occupiers, and workers as to the measures to be taken for the protection of the workmen, and on the recommendations of the Commissioner who held the public inquiry, the Secretary of State withdrew the draft regulations last August. At recent conferences the manufacturers agreed that increased lavatory and bath accommodation, as well as cloak-rooms and drying-rooms, should be provided, and that in most works the elevators should be further encased. Both Mr. Edwards (Cardiff) and Mr. Hilditch (Swansea) have devoted special attention to this trade. Much improvement has been made recently on all the points, and several factories are now accepted as satisfactory. Work in others is still proceeding. Increased use of the washing conveniences is reported from some of the works; and in one the lavatories are so extensive it has been found necessary to build a power laundry on the premises for washing the towels, &c.

Truck.—Under this heading it is reported that, though a long list of fines may be in existence, they are in a great many cases only enforced for repeated offences on the part of workmen. Instances are also constantly being brought forward of decisions on the part of the employers to abolish fines and deductions; and one case in particular is quoted where charges for lighting were entirely abolished throughout a fairly extensive industry carried on in an outlying town. Deductions for lighting, power, and cleaning are, however, still rather common. Those for lighting date back to the days before gas and other forms of lighting were introduced, when the workers used to provide their own candles; those for power and cleaning are a result of the conversion of workshops into factories. In both cases it has, no doubt, been considered that the operative was being supplied with means of doing his work which were not available before, and that he ought, therefore, properly to bear his share of the cost. Customs such as these die out slowly; and one instance in West London is given where the very moderate control afforded by the law was so much objected to that the occupier, rather than make a contract to legalize deductions for light, declared that he would cut it off, and let the pieceworkers provide their own, despite the fact that an excellent high-pressure gas system had just been installed. But though the general position may be regarded as satisfactory, the report says it is still possible to quote cases which emphasize the necessity for legal restrictions. In the Walsall district it was found that the charge made for gas was 6d. (and in one case 9d.) per burner per week. This, on investigation, proved to be excessive, and the charge has been reduced to 3d.

Remarks by the Principal Lady Inspector.

Sanitation.—Under this heading, Miss Anderson reports that an increasing number of complaints are received in several divisions with regard to defective natural lighting and badly adjusted or otherwise defective artificial lighting. The Inspectors do what they can to secure improvement, though, as the matter is outside the Factory Act, no contravention notice or other official action is as yet practicable. Two bad cases concerning women compositors in different parts of the kingdom are specially reported. In both of them artificial lighting was required during the greater part of the day, and in only one of these instances is a remedy being supplied by removal to better premises. In the other case, when the women learned that lighting is still outside the Factory Act so far as their case is concerned, they exclaimed to the Senior Lady Inspector (Miss Squire), "But this is the most important thing of all to us." Miss Anderson quotes the following passage from Miss Squire's report:

> Badly adjusted light, which hurts the eyes, was found in boot factories, where out of nine visited in one town four had the sewing-machine rooms provided with ordinary fishtail burners on a jointed bracket at every machine. These, unshaded, were on a level with the workers' eyes, and close to the face. The girls complained that the light was poor and had a smarting effect upon the eyes. The adaptation of artificial lighting to the requirements of the work receives, in general, very little attention; but I find

that a desire for some guidance in the matter is growing among employers and managers. One difficulty is that of procuring any shade for the big metal filament electric lamps now so largely used. The glare of these in the eyes of machine operatives in all classes of factories is a troublesome accompaniment of the work; and one finds much makeshift screening by workers where such individual effort is permitted.

Another Lady Inspector (Miss Meiklejohn) offered the following remarks on this subject:

A few of the larger firms have taken the matter up; but in the average workroom you find either strong incandescent burners or unobscured and often unshaded electric light. One large firm has adopted indirect lighting. They say that the result is good—the light more nearly resembling natural light. I believe, however, it is more expensive, and a stronger light is required. Another large firm has introduced inverted metal troughs, burnished inside, which come well down over the electric lights. The results appeared excellent; and I am told there is a great saving in electric light, as compared with the old method. The same firm have introduced a very good lamp for sewing-machines. This is a small carbon lamp fixed to, and connected with, the small motor which drives the machine. It has a reflector above, and throws the light on to the needle.

Gas Fumes.—As in many previous years, complaints were investigated in 1913, and were either remedied or are on the way to be remedied, in connection with use of pressing-irons and ironing, blocking, and mounting machinery in wearing-apparel factories, laundries, gold blocking, and other processes. Miss Whitworth found marked improvement in several factories, owing to the substitution of electricity for gas in heating and pressing machinery. Miss Sadler and Miss Taylor find a great deal yet to be done in this direction in tailoring factories. A serious complaint of many fainting attacks in a clothing factory in the South-East Division attributed the effect to the use of suction gas in the pressing-irons. A full and careful inquiry was begun; and the matter is being followed up in the current year.

Humidity and Heat.—Exhausting conditions of humidity and heat are found every year in a considerable variety of processes. Miss Sadler reported that inquiry was made last year in connection with trouble arising from a certain type of pressing-machine in use in the larger clothing factories. These machines are large, and are heated by steam generated by geysers fitted to each machine. The geysers are heated by means of ventilated gas-jets. Miss Sadler says: "In some cases the steam is generated from the boiler; but the high temperatures recorded were much the same. Where gas is used, the heat and steam and fumes from the gas render the conditions almost unbearable;* and we had more than one case of illness from this cause."

Medical Inspector's Reports.

The report of the Medical Inspector contains observations on the following subjects.

Fumes and Gases.—Occurrences of poisoning from such fumes as anilin, carbon bisulphide, benzene and its derivatives, nitrous fumes, &c., which do not come within the definition of a gas, are unlikely to be reported so frequently as poisoning from carbon monoxide and dioxide and sulphuretted hydrogen. Dr. Legge says the figures for 1913 compare favourably with those of the two previous years, as there is marked reduction in the number of cases from carbon monoxide, from nitro and amido derivatives of benzene, and absence of a single case from nitrous fumes. There is increase in the cases from carbon dioxide gas. In reading the reports, he was impressed by the danger of working alone where there is risk of gas poisoning (four of the fatal cases having been due to this cause), and to the risk of working in confined spaces. The reports again show loss of life to rescuers, the dangerous nature of work to which the inexperienced may be put, the carelessness often of those who know the risk, and the value of rescue appliances kept in a state of constant efficiency. Possibly the absence of cases from nitrous fumes is due to the adoption of air or smoke helmets worn by the workers in all departments producing or using nitric acid in the factory where most cases previously occurred, and connected-up with compressed air mains traversing the works in all directions, so as to supply the helmets with air through taps provided with suitable pressure-reducing arrangements. Apparatus for the administration to the unconscious of oxygen from cylinders, as well as the air helmet just referred to, are often kept in gas and chemical works, or wherever there are blast or regenerator furnaces. Instances of the value of the treatment in restoring the unconscious after gassing are frequent in the reports.

Coal and Other Gases.—Of the nine cases of poisoning by coal gas, three (one fatal) occurred in the common practice of drilling mains or branch pipes so as to make a connection without shutting off the gas supply; two (both fatal, one being a rescuer) in repairing a gasholder; and three by escape from gas-fittings—in one case from a pipe supplying a gas iron in a laundry. Among the twenty cases with three deaths reported from blast-furnace gas, eight occurred in charging at the cupola, eight from cleaning operations, mainly of flues, and three in repair work. Of the twenty-one cases connected with power gas, one occurred starting the plant, two in stoking, twelve in cleaning or repairing, and six by escape of gas from a leak in the purifier. In one case the workman, knowing the danger, entered the scrubber through a manhole; while in another the workman chose to lie down to rest beside the engine.

Other Sources of Carbon Monoxide.—Probably the most serious accident which happened last year in the Leeds district from carbonic oxide poisoning occurred in the Leeds Gas-Works. Men were employed under a foreman to do certain repairs to a gasholder from the inside. Previous to entering the holder, air had been blown through for a number of days; but the water in the tank, which had been there for years, was not drawn off. During the time the men were working inside, carbonic oxide was evidently given off from the water, with the result that two men lost their lives (one in attempting a rescue of his mate), and three others were severely gassed. Means for the ready withdrawal of a gassed worker or first aid appliances were absent. Mr. Peacock (Huddersfield) describes how, in removing the lid of a purifier, a man crawled underneath to release the water by withdrawing a wooden plug. When the water had escaped, he should have inserted the plug again; but he was overcome by escaping gas, and two men who attempted to rescue him were also overpowered. Eventually the men were brought out and recovered. But the accident illustrates the danger existing where carbon monoxide can collect in an unventilated space. Since the accident, proper drain-pipes have been provided to the purifier-box, and the turncocks placed in a more accessible and better ventilated position.

Sulphuretted Hydrogen and Ammonia.—Of the eight cases of poisoning by sulphuretted hydrogen last year, five (one fatal) occurred in repairing defects in connection with the apparatus in tar-stills, and one each in gas-works, in connection with the purifying material, and in a sulphate of ammonia plant. Two of the three ammonia cases occurred in connection with the sulphate plant in gas-works, and one in a refrigerator plant from the cracking of the compressor.

Pitch Ulceration.—Dr. Legge furnishes the following particulars upon this subject, to which reference has been made in the "Journal." The Commissioner appointed to inquire into the matter (Mr. A. H. Lush) issued during the year his second report on the draft regulations for the manufacture of patent fuel with the addition of pitch. He had adjourned his previous inquiry in 1911 to allow time to be given to see how far washing accommodation and baths, when made available in the factories, would, or could, be used by the workmen, and also to allow of practical measures being taken forthwith to reduce the excessive dust found in some of the factories. During the interval, the experience with baths and wash-basins, which had been provided in sufficient number to test their value, was contradictory. The majority of the volunteers in Cardiff who had taken the baths complained much of the severe pain in the face and eyes on going out afterwards into the open air; whereas in Swansea, while no experience was gained as to baths, the men largely availed themselves of the washing accommodation provided, and none of them complained of any increase of the pains. In one works 75 per cent. of the men used the wash-basins before leaving. It became obvious that the objects of the Secretary of State might be better secured by some other method than that of regulations. It was accordingly intimated that the draft regulations might be withdrawn, provided a satisfactory arrangement could be come to for carrying out voluntarily by the employers certain improvements which the Home Office deemed essential for the protection of the workers. After a conference attended by representatives of all the large factories in South Wales, such an arrangement, satisfactory to all parties, was arrived at. The terms include the provision of baths, wash-basins, and accommodation for clothing on a scale which, in the absence of compulsion on the workers, should be amply sufficient for all requirements, and also the encasing of the coal elevators as well as those that carry the mixture of coal and pitch, to the reasonable satisfaction of the Inspector of Factories. The number of cases of pitch warts, or of epitheliomatous cancer (the result of them) reported to the Department was 19, of which three were recurrences in persons previously reported.

Late in the autumn, an important experiment to try to improve the conditions of work in one of the patent fuel works in Cardiff was commenced. As a result of Dr. H. C. Ross's work, a method of treating the tar with formaldehyde, which it was alleged (and Dr. Ross himself was inclined to agree) eliminated the auxetic elements in the tar, was taken up by a large firm of tar distillers. In order to see whether pitch from tar when so treated has less effect on the skin than ordinary pitch, the patent fuel works in question decided to use only treated pitch in one works and untreated pitch in another, so that comparison of the effects would be possible. Dr. Ross and the patron of his research fund (Mr. M'Fadden) asked Dr. Legge to nominate three experts to control the results by examination of the workmen from time to time. Eventually this scrutiny was placed in the hands of Dr. E. Stainer, the Physician in Charge of the Skin Department at St. Thomas's Hospital, Dr. Kenneth Wills, the Physician in Charge of the Skin Department at the Bristol General Hospital, and Dr. Scholberg, the Senior Pathologist at the Cardiff Infirmary.

* Why, if the geysers are heated by ventilated gas-jets?—Ed. J.G.L.

Calorific Standard in America.—The "Gas Record," commenting on the change to calorific value which has now begun in earnest in England, states that similar steps may be expected before long in the United States, where a concerted campaign directed at Washington is to be inaugurated shortly.

PUBLIC LIGHTING OF PARIS.

Use and Cost of High-Pressure Gas.

In a preceding issue of the "Journal" [*ante*, p. 18], we indicated the contents of the first of the series of articles on the public lighting of Paris which M. André Grebel lately contributed to the "Génie Civil." In the second he dealt at some length with high-pressure lighting; and as the subject is of considerable interest, we give a fairly full abstract translation of this portion of his communication.

After the French Auer Company had put up their "Colonia" lamps, on a German system, they set to work to construct others in accordance with the patents of one of their engineers, M. Delage. In addition to these, there are at present in use in Paris Graetzin, Pharos, Keith, and Pintsch lamps, all of which give about the same results. The hourly consumptions range from 5 litres per carcel with gas of normal specific gravity (about ·42) and good well-shaped mantles, to 8·5 litres with heavy gas and bad mantles. Usually the consumption is from 6 to 6·5 litres (from 0·21 to 0·23 cubic foot) per carcel (9·6 candles). The yield of light falls off ordinarily with length of use; but it is not very marked till after 100 to 150 hours, although it becomes important at the end of 200 to 300 hours. Under ordinary conditions of working, with replacement of the mantles as soon as their light-giving power has dropped too low—*i.e.*, in practice, 125 hours on an average—the consumption of gas is at the most 6·75 litres per carcel-hour, or 0·7 litre per candle-hour. The extreme figures previously given allow some makers to speak of 0·5 litre and others of 1 litre per candle-hour. Even so, the consumption of enclosed electric arcs imperfectly regulated, and fitted with bad mineralized carbons, would, M. Grebel says, be twice as much as that adopted by him. He thinks he will not be charged with being favourable to gas in taking for his calculations of the net cost of lighting by high-pressure gas 0·7 litre per candle-hour, inasmuch as certain lamps have, as the result of several tests, shown a consumption of only 0·52 litre.

Three-burner Auer lamps of 2000 or 4000 candle power, mounted on lyre-top posts, are already in use in some of the principal thoroughfares of Paris; while two-burner lamps, consuming about 12 cubic feet of gas per hour, light the well-known Avenue des Champs Elysées, and similar lamps are proposed for the contiguous Place de la Concorde. Single-burner lamps, having the same consumption of gas as those just referred to, are employed for lighting the Place de l'Hôtel de Ville. No alteration has been made in the fittings for the high-pressure gas-lamps. The height of the pillars is 16 feet for the 2000-candle lamps, and 18 feet for those of 4000-candle power. Not any of the numerous suspension arrangements, which allow the lamps to be lowered to the ground for cleaning and other purposes, as in the case of electric arc lamps, have been tried in Paris, as they are regarded as ungraceful. For the installation of single or double high-pressure gas-burners in the large lanterns in the Champs Elysées, the Place de la Concorde, and the Place de la République, it has been necessary to adapt recuperative media in the form of cowls, in order to preserve the appearance of the lamps. The pillars are about 13 feet high; and the light centre is 14 ft. 9 in. above the ground. The substitution of incandescent burners for those of the flat-flame type has given rise to a little difficulty in connection with the glassware of the lamps, which is subjected to much higher temperatures than those which the lamps were constructed to bear. It has consequently been necessary to employ a special quality of glass of the Jena kind, similar to that used for making the chimneys of incandescent burners.

M. Grebel proceeds to illustrate and describe the construction of the three-burner, two-burner, and single-burner lamps of the French Auer Company. There are two kinds of the first-named lamp in use in Paris—one fitted with burners consuming 14 cubic feet each per hour, and the other with large burners consuming 24·5 cubic feet each. The lyres in which these lamps are mounted convey the gas to the burners by their two branches; and a tap in the base of the pillar allows of their being supplied together or separately. The lighting and extinction of the lamps are effected as follows: In the course of the day the tap in the base of the pillar is opened, leaving the two supplies of gas fully charged. At midnight the branch supplying two of the burners is closed by a hand-turn of the tap; the remaining burner continuing in operation, as well as the pilot-light. In the morning the compressor stops, and the all-night burner is extinguished; but the pilot-light remains. During the day a man opens the tap completely, and the lamp is ready for night lighting. The arrangements of the two-burner lamp are somewhat similar to those of the one just referred to. The single-burner lamp has only one supply, which terminates in an automatic lighter furnished with a flash-jet. The interior arrangements are different from those of the two other lamps.

The author now comes to the question of cost. The Municipality pay 50 c. per day for lamps of 500 to 1000 candle power, 55 c. for those of 2000-candle power, and 65 c. for the 4000-candle lamps. These prices represent the maintenance expenses, the cost of compressing the gas, and the labour. The replacement of the mantles is done by contract. The mantles are supplied by the Auer and Kern Companies at the price of 65 c. each for the small sizes (350 and 400 litres), and at 90 c. each for the large size (700 litres). Adding the sinking fund in respect of the lamp mountings, which serve several times, M. Grebel says that the figures of 80 c. and 110 c. may be taken. The gas supplied at ordinary pressure is paid for by the Municipality at the rate of 15 c. per cubic metre (3s. 4½d. per 1000 cubic feet). The annual cost of lighting by a 2000-candle high-pressure lamp works out to 701 frs. The number of thousand candle-hours furnished by this lamp, consuming 3013·6 cubic metres of gas in the year, is 4305, reckoning 0·7 litre at the most per candle. The net cost per candle-hour is consequently (70,100 c. ÷ 4,305,000) 0·0163 c. For an effective lower hemispherical luminous intensity of 1714 candles in full lighting, the total cost would be 41 c. per candle-year. For the 4000-candle lamp (3128 effective candle power), consuming 5499·82 cubic metres of gas in the year, the total cost would be 1128 frs. 50 c., the number of thousand candle-hours 7856·85, the cost per candle-hour 0·0143 c., and per candle-year 36 c.

[In his concluding article M. Grebel deals with high-power incandescent electric lamps, low-pressure inverted gas-burners, and other matters bearing upon the subject. This must be left for another occasion.]

FUEL: SOLID, LIQUID, AND GASEOUS.*

We have been much interested in reading this book, which is to a large extent based on the author's series of lectures on "Fuel" at the Sir John Cass Technical Institute. This very wide subject is treated exhaustively and clearly. The author's style is decidedly good; while the reader is throughout never in doubt as to the real meaning of the points under discussion.

The volume is divided into four parts: I., Solid Fuels; II., Liquid Fuels; III., Gaseous Fuels; IV., Fuel Analysis, Calorimetry, and the Control of Fuel Supply. There are in all 19 chapters; and it is noticed that no less than 55 tables, compiled from various authorities, are included, with the object of giving the reader complete data on each subject. Numerous illustrations assist in rendering the subject-matter perfectly clear; while the index is sufficiently comprehensive to enable any particular point to be readily located, which is often by no means the case, as in books, such as the one under review, there is inevitably a certain amount of overlapping in the various chapters.

The treatment of so complex a subject as fuel necessitates the devotion of considerable space to the scientific principles underlying the various systems; but this has not been overdone. The main object has evidently been to collect together and present information which will be readily assimilated by those who, not being specialists, are nevertheless deeply interested, technically or commercially, in the selection and use of fuel in its various forms, and in the plants necessary to turn such fuel into useful energy. The result is a treatise which should be of the utmost value to engineers and to those who are commercially interested in industries which depend on fuel for power and other purposes.

Dealing now with the main contents of the book. Chapters I. to IV. treat of the principles of combustion, the classification and composition of solid fuels, and the commercial varieties of coal. Chapter V. gives details of the preparation of coal. Especially interesting in this connection is the growing use of powdered coal; for, as the author states, "from a large number of tests it is proved beyond any question that high economy is obtained when powdered fuel is used for steam raising 'that smoke is abolished, and that frequently an inferior fuel may be economically utilized." Oven coke has a chapter to itself, and brief mention is made of coalite, charco, and coalexld; but no opinion is expressed as to the commercial utility of any of these special fuels.

These chapters are succeeded by Part II., on "Liquid Fuel," in which the composition and character of fuel oils, systems of burning oil fuel, liquid fuel for internal combustion engines, and heavy fuel oils for such engines are all adequately treated. In these chapters the suitability of tar oils as liquid fuel is discussed; and it is noticed that the change in the character of coal-gas tar, as now made by most of the gas-works, is not fully recognized. So many works are now employing heavy charges that the particulars compiled in Table XXV., in which the composition of crude tars is given, do not fairly represent the true nature of the bulk of the tar that is now being made in horizontal retorts. As a matter of fact, the specific gravity and the percentage of fixed carbon in coal-gas tar has been considerably reduced in the past few years; and this factor plays an important part in the matter of the quantity and value of the tar oils produced.

The whole question of the use of tar and tar oils in Diesel engines, and of the use of benzol as motor spirit, is treated in an adequate and interesting manner. The opinion may here be expressed that the growing importance of liquid fuel should not be overlooked by gas undertakings, who should take pains to investigate every promising process for the production of gas and oil from coals and cannels. If by low-temperature carbonization it is possible to produce gas, oil, ammonia, and coke in profitable quantities, there is no doubt that gas engineers should be to the front in adopting such processes. It is certain that the future will see an enormous increase in the quantity of oil consumed, and gas manufacturers must take care that they are in a posi-

* "Fuel: Solid, Liquid, and Gaseous." By J. S. S. Brame, F.C.S. London: Edward Arnold 1914.

tion to supply. If not it is quite possible that, as a result of the future development in oil production, liquid fuels will enter into serious competition with the products of the gas industry.

The author deals fairly with the importance of town gas as an industrial fuel, though it might be wished that, having regard to the enormous growth in the use of gas for this purpose, rather more space might well have been devoted to the subject. At the same time, the great advantages of town gas as a heating fuel are put before the reader in a thoroughly appreciative spirit.

Several chapters are devoted to the consideration of gaseous fuels of low calorific value. These comprise producer gas from bituminous and non-bituminous fuels, with and without ammonia recovery, water gas, and blast-furnace gas. This section of the work, which is very ably written, also includes a comparison of the cost of power when supplied by steam and gas engines; the latter being fed by suction and town gas respectively.

Part IV. of the book deals with the sampling and analysis of coals, the testing of calorific values, and the purchase of coal on its actual value as a fuel, as determined by its calorific value. Mention is made of the fact that the London County Council buy coal for their electricity power station on such a basis, with, however, compensating increases or decreases in price for higher and lower percentages of ash and moisture content, together with allowances for a greater or less proportion of coal smaller in size than ⅜ inch (square mesh). This system has, it is stated, been proved to have been of advantage to both buyer and seller. Having regard to the unsatisfactory quality of the coal that is so often delivered to gas-works, this method of purchase would appear to be worthy of close consideration by gas engineers.

Mr. Brame has done his work so well that he leaves but little room for criticism. From a gas engineering point of view we do, however, think that gas coke, which is barely mentioned, should have received some amount of attention in any book devoted to the question of fuel. This product should have been properly described, and its main uses named. Considering that something like one half of the coal used in gas-works is put on the market in the form of coke, it is obvious that it is a fuel which should not be neglected. Having regard, too, to the great success with which gas coke is now being used for steam raising purposes it behoves all those interested in the question of fuel to have some knowledge of the properties of gas coke, which is easily procurable in all districts, and at times of strikes, when there is the greatest difficulty in obtaining supplies of coal.

We have every confidence in recommending Mr. Brame's book, and consider that it will soon prove its value among engineering and technical readers as a complete and reliable record on the subject of "Fuel."

COMPRESSED AIR IN THE MODERN WORKS LABORATORY.

By M. Angelo.

In these later days of chemical works practice, there are few works which do not possess some plant or other for the production of compressed air. Such plant may take the form of a fan, blower, or compressor—choice being determined by the particular leanings of the engineer in charge, the chief purposes for which it is to be used, and its first cost and maintenance expenses, with due consideration of local conditions. The principle is applied generally for

(*a*) Power transmission—as West's retort charging machinery.
(*b*) Transportation of liquids—sulphuric acid, oils, &c.
(*c*) Blast production—for water-gas plants, &c.

The writer does not wish to deal particularly with the mere industrial applications of air under pressure and refrains from unduly detailing plant and fittings. The domain of pneumatic engineering is an extensive one, and has a technical literature of considerable range. A reader who is interested in the engineering aspect will do well to consult books that may be available on this specialized matter. For the sake of completeness, however, a few broad generalizations will not be out of place.

The source of blast will, of necessity, depend upon the special requirements and local conditions; the various types having their adherents and opponents. For low pressures, a centrifugal fan is excellent, providing, as it does, a safe blast which varies according to the resistance in the main. When no air is taken from the pressure main, the fan simply churns in its casing and absorbs only sufficient energy to maintain pressure. Therefore no dangerously high strains occur in the case of a blockage. A disadvantage sometimes urged is that a very high-speed drive is required, rendering necessary well-kept machinery and assiduous supervision. Notwithstanding this fact, however, a great number of water-gas units are run by this means.

Positive blowers, such as the "Roots," are used exsensively for the same purpose; and this type of machine will work up to much higher pressures if required.

For still higher pressures, a compressor of some sort is required. This may be belt, steam, or electrically driven, according to whatever facilities are existant. It should be fitted with a governing device, in order to ensure that a constant pressure is automatically maintained, and that the most economic conditions prevail.

Transportation of Liquids.

The principle of the "acid-egg" or "monteju" for the transportation of strong sulphuric acid is so well known as to require no description. Air-pressure is undoubtedly the most economical means of dealing with crude products on tar-works, and by its means acid, alkali, oils, and even molten pitch can be transported from place to place as occasion demands. Many chemical works also make use of air-jets in mixing vats where thorough agitation is required. It is the compressed air from such an installation that the writer has adapted to his service in a large laboratory. Fortunately, so it happens, a portion of the compressed air main passes close by the laboratories, and it was decided to lay on a ½-inch pipe.

As the air pressure—between 20 and 30 lbs. per square inch—was subject to small fluctuations, it was thought advisable to reduce this fluctuation by having an air-receiver of 3-gallons capacity. This was rigged up in a corner of the laboratory, with a non-return valve and a stop-cock at the inlet. To the base was fitted a drain cock for the removal of any condensed water. This was found to be a very useful and necessary fitting. The receiver was supplied with a pressure-gauge, and from the top was taken the ½-inch service to the laboratory benches, where the blast was to be used.

Fig. 1 gives a general idea of the fittings. All joints were made with red lead; and after the completed scheme had been in use for a week or so, it became practically air tight. The receiver might be charged up to 25 lbs. per square inch on a Saturday morning and left with all cocks shut. By Monday, the gauge rarely gave a reading below 20 lbs. Nothing more satisfactory

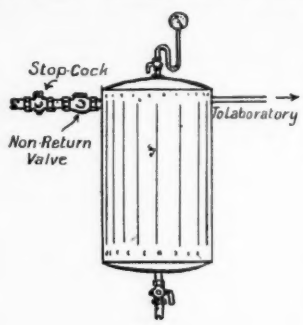


Fig. 1.

Fig. 2.

could be desired. Brass fittings of ¼ inch were used throughout. For general use about the laboratory no valves were used, but good taps or cocks with elongated taper nozzles, as depicted in fig. 2. This particular type was chosen because it allows of rapid and convenient connection of the rubber pressure tubing.

Applications.

The first, of course, was for blow-pipe work; and as in all other large laboratories where a considerable amount of glass working has to be done, it soon paid for itself. The manipulation of large tubes became much easier, as one could keep a steady hand and a more regular blast. The small boy who erstwhile worked the bellows was found other employment, and his instrument was soon consigned to the store-room, whence it has never since emerged.

For work where mechanical stirring is required—*e.g.*, for a large thermostat—the following answers admirably. To the end of a wooden disc, about 6 inches diameter, a number of tin vanes are nailed. The disc is then mounted at the top of a long brass spindle, fitted near the lower end with suitable stirring arms. A hollowed-out piece of metal is placed at the bottom of the tank and serves as a support for the spindle, the end of which may

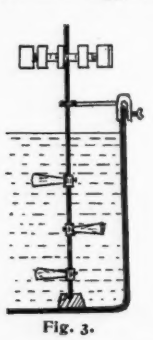


Fig. 3.

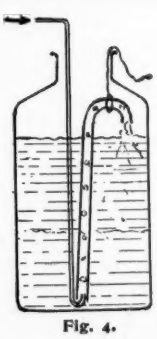


Fig. 4.

be sharpened to a point to secure better working. A ring support is required to maintain the position of the spindle; and when a jet of air plays on the vanes the whole concern rotates. I have had this very simple apparatus working continuously for days at a stretch, requiring no attention and using very little power. See fig. 3.

Where comparatively large bulks of solutions have to be mixed—such as the treatment of oils with soda or acid solution—the bubble system may be applied with advantage. Circulation of the lower layer is created by passing a fine jet of air up an immersed tube of somewhat larger diameter. The separate bubbles of air entrap a certain amount of the solution and carry it upwards to the top, where it is spilled and descends again through the lighter liquid to the bottom of the vessel (fig. 4). In this way the two liquids come into intimate contact with each other.

It often occurs that several gallons of tar oil have to be treated for the extraction of phenols, &c. In such cases the necessary fluids can be put into a vessel and the air-jet left going overnight. A great advantage lies in the fact that no trouble is experienced in separating the two layers, as is often experienced when mechanical agitation is resorted to. When making up quantities of saturated solutions the same principle may be applied—just put the solid into the water, turn on the air-jet, and leave till finished.

An air-jet is also helpful in evaporation, particularly when it is necessary to deal with large bulks of liquid. The effect of a current of air directed upon the surface of the hot solution is surprising. When introduced below the surface of the hot liquid, evaporation does not appear to proceed so rapidly; for only a limited flow can be used, or splashing is likely to occur. The

Fig. 5.

idea, of course, is to drive away the air before it becomes saturated. Care should be taken that the air-blast contains no dust or gaseous impurities such as would contaminate the liquor being concentrated. The filtering bottle shown in fig. 5 has proved to be an efficient guard against such possibilities. It may be loosely packed with cotton wool or sponge.

A gentle stream of air was introduced to the interior of a water-oven, thus creating better circulation—the ordinary drying oven suffers notoriously from the faults of bad ventilation. It was found possible to obtain constant weight after two hours' treatment of samples which formerly took from four to five hours to dry. This speaks for itself.

Hot air for drying the interiors of bottles and flasks was readily produced by means of an iron heating tube through which the air passed. After washing the bottles, they were inverted over a vertical tube connected to the hot tube, and were perfectly dry in thirty seconds. This fitting was eminently useful for drying lengths of glass tubing.

The air-blast lends itself readily to many other uses in the laboratory. It is, by the way, an ideal means for cleaning fine sieves after these have been used and become partially blocked. Each one may find fresh developments as he goes about his daily work. For high-temperature work, it should be mentioned, compressed air may partially replace high-pressure gas, where the latter is not already laid on.

THE "LANCET" HYGIENIC TEST FOR GAS-FIRES.

[From the "Lancet" for July 11.]

JUDGING from the considerable correspondence that we have received from various well-known makers of gas-fires, the test originated in the "Lancet" laboratory for arriving at the hygienic efficiency of these fires, and described for the first time in these pages on Feb. 7, 1914 [reproduced in the "JOURNAL" the following Tuesday], has met with general approval and wide acceptance. In a report subsequently published in the "Lancet" for April 4, 1914 [see "JOURNAL," April 14, pp. 96-9], the results of the examination by this test of a number of gas-fires then upon the market were presented. The list of gas-fires examined was a very representative one; but we stated at the time that any omissions would be repaired in a subsequent article, if the makers would submit any new designs claimed to be an advance on existing types.

This invitation was accepted; and within a week of the publication of the report Messrs. John Wright and Co., of Essex Works, Aston, Birmingham, submitted to us twelve of their 1913 pattern stoves, which, as the following results show, passed the requirements of the "Lancet" test perfectly, even when no flue length was attached to the flue-nozzle. There was no forward escape of combustion products at all.

In the following table the straight lines represent the rim of the canopy of the stove, which was tested at five different points. The lines are only drawn straight for diagrammatic purposes and for convenience of printing, and do not necessarily represent the shape of the canopy, which may have a straight or curved rim, as the case may be. Where the sign "o" occurs, it signifies no leakage; in the event of leakage, the sign + is used.

THE "LANCET" TEST OF GAS-FIRES (JOHN WRIGHT AND CO.).

Name of Fire	*Standard.*	*Swastika.*	*Forum.*	*Druid.*
Without elbow	ooooo	ooooo	ooooo	ooooo
2-ft. elbow attached	ooooo	ooooo	ooooo	ooooo
Name of Fire	***Herald.***	***Sorcerer.***	***Merlin.***	***Talisman.***
Without elbow	ooooo	ooooo	ooooo	ooooo
2-ft. elbow attached	ooooo	ooooo	ooooo	ooooo
Name of Fire	***Warlock.***	***Stadium.***	***Mascot.***	***Wizard.***
Without elbow	ooooo	ooooo	ooooo	ooooo
2-ft. flue attached	ooooo	ooooo	ooooo	ooooo

Further experience of the test shows that certain precautions are necessary in applying it. It proves to be very delicate; and a gas-fire which gives absolutely negative results with it has passed through a severe ordeal. Occasionally a leakage is shown at the extreme ends of the canopy, which often proves to be due to a slight external draught. In order to obviate this disturbance, it has been found necessary to protect the stove from such outward disturbances by placing it within a three-way screen, the wings of which keep draughts away from the field of combustion or from the exit nozzle. This accounts for a discrepancy in the previous report, in which apparently the Merlin stove of John Wright and Co. showed a slightly increased leakage after a 4-feet length of flue had been attached, whereas with a 2-feet flue, which should render less assistance to the ventilation of the combustion products, the results seemed to be better. In either case, however, the leakage was so small as to be hygienically negligible; and the fact that it was only occasional pointed to an external disturbing factor.

During the test, therefore, the fire should be protected from draughts. In the test, it may be remembered, an absorbent pencil—made, for example, of chalk—is soaked in carbon tetrachloride, and placed near the air inlet of the gas-fire. Traces of carbon tetrachloride are thus drawn into the burners, with the result that (on combustion) hydrochloric acid is produced, which, although present in small proportion, is readily detected by coming into contact with ammonia, forming dense fumes of ammonium chloride. If, therefore, the products of combustion are "bye-passing," this will instantly be shown by fumes being produced when an open tube containing strong ammonia solution, or a sponge soaked in the solution, is placed at various points along the rim of the canopy.

We have also received from Messrs. Arden Hill and Co., of Acme Works, Birmingham, four gas fires for test. The results are given in the following diagram. They show, again, that these fires are so constructed as to permit of no escape of combustion products at all except by way of the flue-nozzle; and the attachment of a 2-feet length of flue was not necessary in any case.

THE "LANCET" TEST OF GAS-FIRES (ARDEN HILL AND CO.).

Name of Fire	*Gnome.*	*Loka.*	*Olak.*	*Kalo.*
Without elbow	ooooo	ooooo	ooooo	ooooo
2-ft. length attached	ooooo	ooooo	ooooo	ooooo

These results justify our expressed conclusion that "the present attitude of the gas-fire industry towards all questions of improvement is a most satisfactory one; and our inquiry shows that we may fairly expect in the near future an encouraging and hopeful issue." Progress in the direction indicated will mean that no reproach based on hygienic considerations against the radiant system of gas-heating can remain.

We are still conducting tests with fires received from other makers; and we shall publish the results from time to time as the experiments are completed.

Separation of Gaseous Mixtures.—Mr. E. N. Mazza has taken out a German patent [No. 272,853, Dec. 10, 1912] for a process and apparatus for the separation of gaseous mixtures. According to an abstract of the specification in the current number of the "Journal of the Society of Chemical Industry," the separation is effected by converting the potential energy of the gaseous mixture into kinetic energy by passage through a curved tube of diminishing cross section from inlet to outlet, whereby the lighter and heavier constituents accumulate respectively near to, and more remote from, the centre of curvature of the tube. The apparatus consists essentially of a chamber to which the gaseous mixture is supplied, and another to receive the separated heavier constituent. Between these are one or more separating elements, each consisting of two portions—viz., one in which transformation of the potential energy of the mixture into kinetic energy first takes place, and the other which is the separator proper.

GAS APPLIANCES AT THE LYONS EXHIBITION.

[From Our Own Correspondent.]

Object of the Exhibition.

The object which M. le Sébateur Herriot, the Mayor of Lyons, had in view in organizing an International Exhibition in that beautiful city, was stated by himself as follows:

> We wished to study one by one the various media of the city, and to demonstrate what the joint endeavours of scientists, administrators, manufacturers, and merchants can contribute towards its progress. The hour has arrived for us to found our ideas upon the observation of facts, and, if this notion cannot yet be applied to the State, to establish, upon a patient and well-advised study, the material, intellectual, and social life of the city. It will be the work of the Twentieth Century to establish, upon data borrowed from science, the laws to guide this organism so badly defined. It is because we believe in this future that we have endeavoured to assemble within the precincts of an exhibition the greatest number of elements requisite for this work.

The exhibition is, therefore, one of urban life, and it has been installed in the vast buildings which are later to be laid out for abattoirs. All the great problems with which communities are now confronted so imperiously are studied in special sections, which in the majority of cases had never independently existed in any French exhibition—relief of the poor, hospitals, cure of tuberculosis, anti-alcoholism, education of boys, hygiene of labour, sanitation, water supply, the removal of nightsoil, and, of course, lighting, both gas and electric.

Lyons as a Gas Centre.

The place occupied by gas in the exhibition is a most important one. It constitutes, in a way, a small exhibition within a great one; for not only are the gardens and halls largely lighted by gas, but gas also occupies, as it were, the place of honour at the entrance of the main gallery. Such a favour can be easily explained. Lyons has for a long time been a great centre of the gas industry. Eight of the leading French gas companies have their headquarters in the city; and well-known engineers—such as MM. Th. Vautier, Lachomette, Piaton, and Godinet—have their offices and laboratories there. Moreover, Lyons has provided a good number of Presidents for the Société Technique, especially M. Boutan, who, in so masterly a manner, directed the proceedings at the last two congresses.

One might also testify, were it necessary, to the importance of the gas industry by the excellent relations existing between the Lyons Gas Company and the municipal authorities and the consumers. Very attentive to their duties, the Company, who supply both gas and electricity to the city and the large communes in its vicinity, have greatly developed their works, and made all the sacrifices that are necessary to meet the requirements of a very large industrial population—thereby winning the esteem of their numerous clients.

Public Lighting.

The lighting of the gardens of the exhibition is carried out with gas at ordinary pressure with upright Auer or Visseaux burners, and also with inverted burners of the Graetzin, Gobo, and Auer types. In addition, there are 50 large high-pressure gas-lamps in front of the palaces in the entrance courtyard and in some of the galleries. They are "Pharos," Gobo, Graetzin, or Auer-Delage lamps of 1000 to 4000 candle power. The Lyons Gas Company have, as it were, reconstituted the history of street lighting in the city on a special stand, at which are to be seen argand and open-flame burners, in use since 1842, and the last of which did not disappear until 1902. Then come quite a series of incandescent burners—Auer, Bandsept, and finally the large modern high-pressure burners.

Exhibit of the Lyons Gas Company.

This very interesting exhibit covers an area of more than 5300 square feet, and comprises all the applications of gas and electricity, presented in surroundings adapted to their utilization. There are to be seen examples of the use of gas in works for annealing and tempering metals, in heating-stoves for drying varnishes, in foundry moulds, for heating steam-boilers, electrolytic baths, tiring locomotive wheels, &c. A high-pressure gas station feeds special glass furnaces, blowpipes for melting metals, &c. Other stands, arranged with the best of taste, represent suites of rooms or flats heated and lighted with gas; a complete kitchen, with coffee roaster, water sterilizer, bath-room; and a laundry, with gas-irons and a mangle. There are also on view a boiler to pasteurize milk, a complete economic shower-bath installation, and vats and ovens for preparing pork butchers' products. In a special pavilion, the Company have installed two gas-ovens for bakeries. One of them is the usual French bakery oven, and heating is obtained with Méker or Meyer burners, which can be employed without necessitating alterations. The other is a special type of oven heated from the exterior, on the Bromham system, constructed by the Compagnie Continentale des Compteurs à Gaz. These ovens are working, so that visitors can appreciate all the advantages of heating by gas—the cleanliness of the bakehouse, rapidity of heating, abolition of the carriage and chopping of wood, chimney cleaning, &c., and, in particular, improved conditions for the workmen. It should be added that for this particular purpose gas is sold in Lyons at 3s. 3d. per 1000 cubic feet.

Mention must be made of a very interesting demonstration of what can be done with 100 kilos (220 lbs.) of coal. Side by side with a block of coal of this weight, there is a single-burner lantern which can be supplied for 320 hours by the gas resulting from its distillation; then there are 47 kilos. of large coke, 15 kilos. of broken, 4 kilos. of small, 5 kilos. of breeze, 12 kilos. of ammoniacal liquor, 4·5 hectogrammes of tar, 525 grammes of volatile alkali, 400 grammes of spent and a like quantity of revivified purifying material, 315 grammes of naphthalene, 385 grammes of heavy oil, 180 grammes of anthracene oil, 30 grammes of benzol, 23 grammes of xylol, 32 grammes of prussiate, and 8 grammes of sulphocyanide of copper, and 5 grammes of phenol oil.

Along the walls of a sitting-room there are maps, plans, and diagrams showing the lengths of the gas and electricity distributions of the Company, the arrangements of their different works at Villeurbane, Perrache, and La Mouche, their high-pressure gas and electric stations, the extent of their business, and the nature of their social work. The following are some statistics showing the progress made in the period stated:

	1881.	1913.
Consumption of gas, cubic metres	21,103,000	46,856,000
Price of gas per cubic metre	30 c.	19 c.
Number of consumers	27,426	113,260
Number of public lamps	6,000	12,000
Length of mains, metres	282,675	707,340
Royalties paid to the city	465,000 frs.	565,000 frs.
Average wages of workmen per day	—	5·85 ,,
Grants to the employees	—	332,052 ,,

The grants made by the Company to their workmen are considerable—in the form of pensions, gifts, and relief, 80,034 frs.; as their contribution for the constitution of a special pension, in addition to that provided by law, 104,328 frs.; payment to the lamplighters' and workmen's relief fund, 37,157 frs.; insurance premiums, 57,174 frs.; and finally, as a special grant for large families, 53,359 frs. No greater praise can be given to the Company than that evoked by the publication of these figures.

Some Gas Companies' Exhibits.

The Société du Gaz de Paris, the Société d'Eclairage, Chauffage, et Force Motrice, the Société Générale d'Éclairage pour la France et l'Étranger, the Société du Gaz et de l'Électricité, Marseilles, the Groupe Lyonnais du Sud-Est, and the Groupe Vautier, have exhibited photographs of their works, plans, diagrams, &c. The following are some figures taken at random: The Société d'Eclairage, Chauffage, et Force Motrice, who light the Paris suburbs, demonstrate their prosperity and development, under the management of M. René Masse, by the following statistics:

	1905.	1913.
Consumption of gas, cubic metres—		
Per consumer	788	573
Per inhabitant	51	11
Per kilometre of main	32,972	55,586
Number of consumers	65,265	255,718
Annual output, cubic metres	51,513,000	135,248,675

The Groupe Vautier serve a total population of 1,500,000 inhabitants; the Compagnie Générale pour la France et l'Étranger sell, from their 24 works, 22,000,000 cubic metres (777 million cubic feet) of gas in France and 62,700,000 cubic metres (2213¾ million cubic feet) abroad. The maximum output per hour in December for the Société du Gaz de Marseilles increased from 10,500 cubic metres (370,600 cubic feet) in 1905 to 18,300 cubic metres (646,000 cubic feet) in 1913.

The Paris Gas Company show, by the aid of a series of fine photographs, the numerous applications of gas-machines for ironing collars and wristbands, hot-air engines for sewing-machines, &c., installations of gas kitchens for middle-class houses, hotels, and boarding-schools, bath-rooms, central heating, and other purposes. Models (to one-tenth scale) show the arrangement for cooking by gas in the warehouses of "La Samaritaine;" a set of three frying-pans, each equal to the preparation of about 200 lbs. of fried potatoes in twelve minutes; and grills capable of cooking 130 beefsteaks in seven minutes. Another model is a section of a house, showing an installation of central heating on each floor by means of a gas-boiler, a system of automatic lighting, &c. The whole of this exhibition, which is very well arranged, full of information, and including some curious documents, is completed by some plans and statistics, from which the following striking figures may be quoted. In 1856 the number of gas consumers in Paris was 50,000; to-day it is more than 600,000.

Bread Baking by Gas.

The Paris Gas Company, like the Company at Lyons, have installed a baker's oven constructed by the firm of Eschalié et Biabaud, and heated by means of a new burner brought out by the Société l'Appareil Contrôleur, and named the "Cryptos" [see fig. 1]. Composed of a group of bunsen burners, it is fixed under the bottom of the oven, just below a hole which is generally closed by a plate of cast iron, and provided, at the moment of

heating, with a kind of cap which allows the flames to be directed towards all parts of the oven. The results obtained with this appliance are excellent. According to the statement of a Paris baker who employs two of them for the whole of his production, he bakes twelve batches of sixty loaves each with from 2600 to 2800 cubic feet of gas.

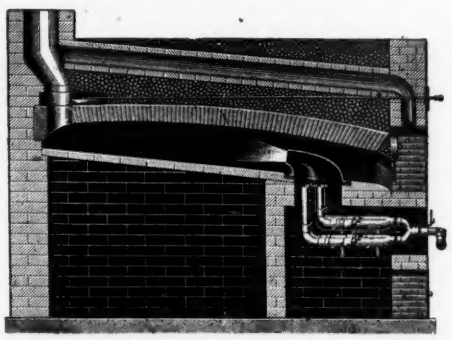


Fig. 1.—The "Cryptos" Oven-Heating Burner.

With the oven shown by the Lyons Gas Company the Méker burner is employed. It was the first appliance constructed for this purpose, and it is still among the best of them. It consists of a large burner with two diverging heads suitably partitioned. Brought in front of the oven upon a light carriage, and attached to the gas-piping by means of a flexible tube, it simply stands at the mouth of the oven without any alteration of the structure. The following results were obtained quite recently at Strassburg: With a consumption of 2000 cubic feet of gas, 1672 lbs. of bread were baked, and considerable economy was realized as compared with heating the oven with wood.

Sundry Exhibits.

The stands of the following exhibitors attracted special attention: The Société Internationale du Gaz Surpressé, the firm of Saumer Duval ("Gobo" gas-burners, high-power lanterns, and "Vesuvius" bath-heaters), the "Autolume" (platinum sponge lighters), "Couronne" mantles, and the fine stand of the firm of Visseaux, of Lyons, at which their upright burners were to be seen. The latest type of these burners produced—the "00"—consumes 2·5 cubic feet of gas, and gives the light of about 10 candles. The firm also showed their inverted burners and the "Girator" burner, with a blue flame pilot-light, easily mounted on automatic lighters. The visitors to the exhibition have the opportunity of seeing mantles of artificial silk, which has made its reputation for this purpose, knitted, impregnated, and burnt off. The Société Française de Chaleur et Lumière show their heating and cooking appliances on the Clamond system, gas-boilers for central heating, an apparatus for the distribution of hot water in large quantities, "Pharos" lamps, burners for compressed gas, designs for the installation of central heating, and a scheme of shower-baths supplied by generators of 50,000 calories capacity. The Société Française Graetzin exhibit numerous types of burners and intensive lamps with and without high pressure. The Société Française Auer have on view their new Auer-Delage lamps. Seeing that it is costly, and not always practicable, to instal large light centres of compressed gas, which necessitate special lanterns and pillars, the Company's Engineer, M. Ménager, has devised a lamp of 600-candle power with a mantle protected by an envelope of silica, which may be fixed in ordinary lanterns slightly altered.

Among the heating appliances, those of Martin, Bécuve, Richard, Brachet, and Pravaz et Cie., deserve special mention. Among other novelties are shown a large cooking-stove suitable for a hospital and apparatus for the sterilizing of milk. The firm of Laborderie have on view pastry and other ovens; M. Pilot shows a cooking-stove with water-bath heated by the waste heat from the oven, and stoves for the special treatment of silk; and M. Ratti exhibits turning stoves for baking thin cakes, &c.

The Compagnie pour la Fabrication des Compteurs have a particularly interesting stand, at which may be seen specimens of their productions—exhausters, Roots blowers, a model (one-tenth scale) of a station meter for 3½ million cubic feet of gas per day, a compressed air meter for the control of pneumatic apparatus, consumers' and test meters, automatic lighters of Kilchmann and Gaulis, &c. The Société Industrielle des Compteurs show a large number of various types of ordinary "Duplex" meters, with injectors, and an unoxidizable meter entirely lined with lead. The Compagnie Continentale pour la Fabrication des Compteurs have on view, in addition to meters, registers and different models of charging and discharging machines.

The Photometry Section of the exhibition is well furnished by the Compagnie pour la Fabrication des Compteurs, who show photometers by Sugg, Simmance and Abady, and Lummer and Brodhun, Junkers and Simmance calorimeters, &c.; and by the Compagnie Continentale, who show a French regulation photometer, photometer meters, &c. From the Photometric Laboratory of the Faculty of Lyons has been sent a complete bench, with carcel and Harcourt standards, together with various publications by the Director, M. Th. Vautier. The International Photometric Commission have a show-case in which may be seen the reports of their proceedings and various documents bearing upon their work.

Special mention must be made of the exhibit of the French Coke Committee, who, under the presidency of M. Rouland and the commercial management of M. Delaporte, are carrying on very useful work. Diagrams show the progress made by the Committee, the development of the export of coke, &c.; and, by the aid of printed matter, the conditions are laid down for employing coke to the best advantage for industrial purposes and for economic heating. Special appliances in this connection—such as the Martin heater and the Grouville and Arquembourg boiler for central warming—complete the collection.

This necessarily short account of the exhibition may be fittingly terminated by notices of some of the new appliances shown there.

The Méker Burners.

It may be truly said that the reputation of these excellent burners is world-wide. They are adopted everywhere as laboratory burners; and their applications to industrial heating are innumerable. The perfect regularity of combustion which they ensure, and the high temperature of the resulting flame, are very widely appreciated. Reference has already been made to the special use of these burners for the heating of bakers' ovens. It now remains to say that among the numerous appliances shown are furnaces for the thermic treatment of metals and for the rapid manufacture of steel, gas forges and forging-tables (one of which is shown in fig. 2), furnaces acting without blowers for the fusion of soft metals, and others with blowers allowing of the attainment of temperatures of from 1700° to 1800° C. (3100° to 3300° Fahr.). There are also heating-tables, furnaces with lead or nitrate baths (see fig. 3), and special burners for the bending of pipes intended for lighting by luminescence.

Fig. 2.—Gas-Heated Forging Table.

Fig. 3.—Méker Furnace Burner.

The Clamond Boiler.

This boiler is shown at the stand at which is to be seen the operation of conditioning silk, where it serves for heating the coils and the drying-stoves. At the same time, it is susceptible of a large number of other applications. It is, however, specially suitable for central heating at low pressure. It is constructed of sheet steel, and, as will be seen from the accompanying illustration (fig. 4), consists of a double cylindrical casing A B, with a central tube C E; the whole being suitably partitioned to cause the circulation of the water. At the upper part there is a steam-chamber of sufficient size to avoid the carrying forward of water.

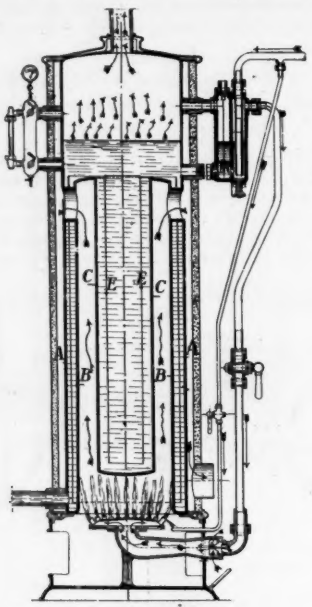
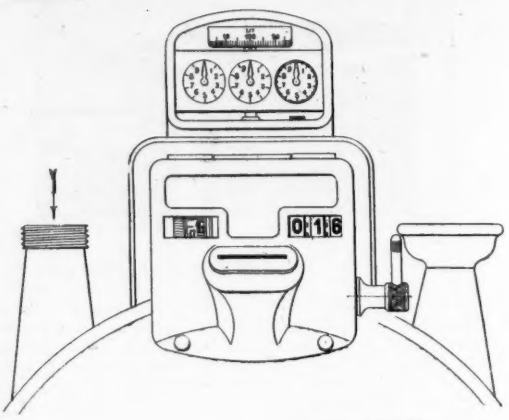


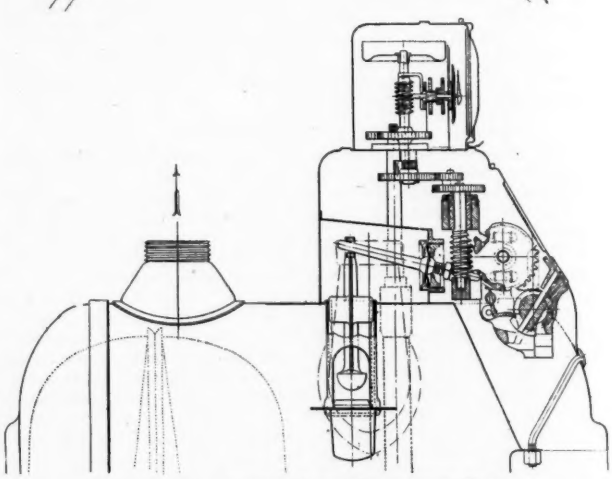
Fig. 4.—The Clamond Boiler.

The burner is a group of bunsens, and it is ignited by a pilot-light. An outside bottle, with water-level and control taps (shown on the left of the drawing), allows of the working of the boiler being ascertained at any moment. An automatic mercury regulator (on the right), consisting of a cast-iron vessel forming a syphon, and communicating with both the boiler and the gas inlet, lowers the flame of the burner to the size of a pilot-light as soon as the pressure determined upon is attained. The appliance is provided with an automatic safety-valve, which allows the steam to escape when the pressure reaches a certain limit.

New Prepayment Meters.

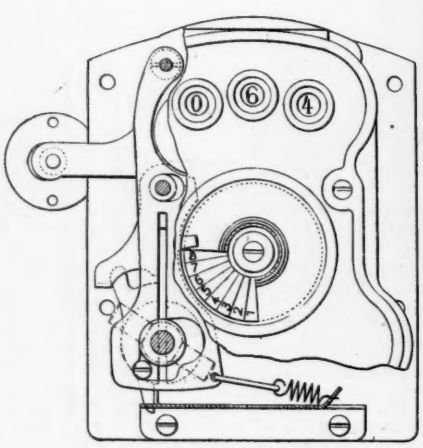
The Compagnie pour la Fabrication des Compteurs and the Société Industrielle des Compteurs each show a "Duplex" meter of their special type, with prepayment mechanism. The latter Company have succeeded in producing an automatic meter which does not occupy more space than an ordinary one; all the mechanism being encased in the front part. A general view of the meter is given in fig. 5; and the mechanism, which consists essentially of differential gear, is shown in figs. 6 and 7. The ratchet-wheel upon which the coins act is fixed to the clutch of a pinion upon which loose pinions turn. These engage with the inner teeth of a wheel carrying exterior teeth upon which, through the agency of a suitable organ, the fly-wheel of the meter acts. The dial indicating the available supply of gas is formed by a white helicoidal disc, which can be totally or partially displaced behind a black screen of the same shape, and entirely or in part masked thereby. This new device constitutes a dial by means of which the consumer can see at a glance what is his supply of gas, which may correspond to thirty coins. The figures appear very clearly in little round openings at the top of the box containing the mechanism.

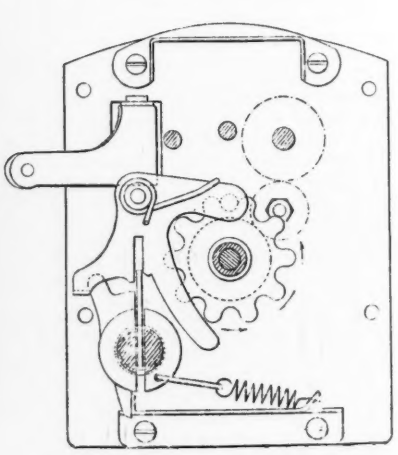




Figs. 8 and 9.—Another French Prepayment Meter.

The meter of the Société pour la Fabrication des Compteurs also comprises a train of differential gear wheels, but with bevel gear. The loose pinions open and close the gas inlet-valve, indicate the supply of gas available, and the closing of the orifice for the introduction of the coins. This mechanism (figs. 8 and 9) is lodged in front and below the clockwork case, which is thus raised. The stopper of the valve is worked by an oscillating lever





Figs. 5, 6, and 7.—A French Type of Duplex Prepayment Meter.

with ball-and-socket joint worked directly. The gas reserve and the number of coins still to be used are both indicated by moving figures appearing in two openings. A special arrangement of the mechanism prevents coins smaller than a penny from falling into the money-box, and throws them out of the meter.

These two meters have the characteristics, in common, of dispensing with a new stuffing-box, and having easily removed mechanism, in which the alterations required when the price of gas is changed are limited to removing a single wheel, and in the case of change of coins to the replacement of one part which can be easily reached.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

REPORTS OF THE TECHNICAL COMMITTEES.

II.—THE PIPE COMMITTEE.

The annual meeting of the Association last year at Strassburg agreed to the appointment of a Pipe Committee to investigate various questions raised by the Council and by District Associations and various members and municipal authorities in connection with the pipes for gas mains and services.

The Committee have held nine meetings and have found that the questions referred to them are very comprehensive. The matters considered in the first instance may be classified under four headings—viz.:

(1) Distribution at high pressure. Leakage and other observations on long-distance mains, and the applicability of formulæ for loss of pressure, &c.

(2) The applicability of cast-iron and wrought-iron (steel) mains; their differences, collection and comparison of experiences from the physical-chemical standpoint, strength and durability, and behaviour in movements of the soil and in different classes of soil, &c.

(3) External diameter of pipes and the joining of cast-iron on wrought-iron pipes.

(4) Uniform signs and colours for plans of pipes and mains.

For dealing with these matters the Committee formed themselves into four Sub-Committees. They have not arrived at final conclusions in any of the divisions of the work, but give a brief report on the progress so far made.

(1) Distribution at High Pressure.

The Mid-Rhenish Association of Gas and Water Engineers, as the result of a discussion, on the proposal of Herr Eisele, suggested that it would be useful to study whether it would be advantageous to increase the customary distributing pressure by (say) 4 inches to 8 inches of water.

The statement laid before the Committee enumerated the advantages of the increase of pressure as follows:

(*a*) Reduction in the effect of fluctuations of pressure, higher capacity of distributing mains and service pipes, and reduction of interference of the supply due to too small or blocked pipes or high resistance of meters.

(*b*) Increased economy in consumers' appliances, greater ease of control and less sensitiveness to fluctuations of pressure or careless regulation, wider applicability to industrial purposes.

On the other hand, disadvantages which might be anticipated and which should be investigated were:

(*a*) Increased loss of gas from the distributing system and services, larger escape of gas from broken pipes, excessive water seal for gas-meters, &c., leakage from taps, sockets, stuffing-boxes, &c.

(*b*) Smoking of consumers' burners, &c.

The question may be subdivided thus:

(1) Does increased pressure present advantages to the consumer, and can the ordinary consumers' appliances be generally retained with an increased pressure?

(2) Would new industrial uses of gas be opened-up by increased pressure?

(3) Do the gas-works on the whole secure advantages from the increased capacity of the mains which are not outweighed by attendant disadvantages?

The Committee have thought it most important to settle the first of these questions—viz., as to the advantages to the consumer. In order to do this, inquiry was made; and the Instructional and Experimental Works of the Association was asked to make investigations on the economy of the most usual consumers' appliances with increase of pressure. The points on which inquiry was made were as follows: (*a*) Have you made experiments on the output of gas to consumers at increased pressures of 4, 6, or 8 inches of water? (*b*) What was the highest pressure? (*c*) What was the lowest pressure? (*d*) Was the maximum pressure at the works or at a high part of the town? (*e*) Were the usual burners, cookers, &c., used, or what changes were necessary. (*f*) What is the result of your experience as to the advantages from the economical or working standpoint? These questions were directed to seventy firms and gas undertakings—chiefly works in large towns and those medium-sized works in which it was anticipated that high-pressure distribution had been tried. There were received 58 replies, of which 28 were informative.

The replies and experiments reported below lead the Committee to conclude that probably no considerable advantages ensue to consumers who only use gas for lighting and cooking purposes, when the pressure is increased by 4 or 8 inches, if new types of burners specially designed for such pressures are not adopted. It remains to be proved whether increase of pressure might not greatly stimulate the industrial use of gas; and this matter is being kept in the foreground of the Committee's inquiries. The experiments made by the Instructional and Experimental Gas-Works on the effect of increase of pressure on the efficiency of boiling rings showed that when the pressure was increased from 16-10ths to 39-10ths, using the same kettle and the same nipple on the ring, the efficiency was reduced from 55·25 to 50·7 per cent., though the time taken was considerably less. Altering the nipple to suit the increased pressure raised the efficiency to 56·2 per cent.; the time taken being nearly as long as at 16-10ths pressure. When a larger kettle was used with the original nipple, the efficiency was 55·1 per cent. When the pressure was raised to 59-10ths, the efficiency with the original nipple and kettle was 47·5 per cent. With an alteration of nipple this was increased to 53·5 per cent.; and a change of the kettle, retaining the original nipple, gave an efficiency of 56·9 per cent. The results indicate that with any considerable increase of pressure it is necessary not merely to change the nipples, but to alter the construction of the boiling ring, or the size of the vessel used on it, in order to maintain or increase its efficiency.

Experiments made by the Instructional and Experimental Gas-Works on the effect of increase of pressure on incandescent burners were made on three types of burner—viz., the Windemüller, the Welsbach "C" upright, and the Graetzin. At 16-10ths pressure the Windemüller burner had a duty of 1·09 litres per hefner (= 23·24 candles per cubic foot). With an increase of pressure to 39-10ths, without adjustment of the regulating nipple, the duty fell to 1·98 litres per hefner (= 12·79 candles per cubic foot); but on adjusting the regulating nipple the duty of 23·24 candles per cubic foot was recovered. The fluctuations of pressure, such as would be caused by a wave of pressure for pressure igniting devices, caused a fall in duty. When the pressure was increased to 59-10ths, and the nipple regulated to suit this pressure, a duty of 1·13 litres per hefner (= 22·41 candles per cubic foot) was realized. But the burner was noisy and very sensitive to slight fluctuations of pressure. Broadly, the duty of this burner, which is normally high, is not affected when the pressure is increased to 4 inches; but an increase to 6 inches makes it practically unusable. The Welsbach "C" burner, on the other hand, has a duty of 1·5 litres per hefner at 16-10ths pressure (= 16·89 candles per cubic foot), which is improved to 1·4 litres per hefner (= 18·1 candles per cubic foot) when the pressure is increased to 39-10ths and the nipple regulated accordingly. An increase of pressure to 63-10ths improved the duty to 1·34 litres per hefner (= 18·90 candles per cubic foot). The Graetzin inverted burner showed a duty of 1·12 litres per hefner (= 22·62 candles per cubic foot) at 16-10ths pressure, and a duty of 1·065 litres per hefner (= 23·78 candles per cubic foot) when the pressure was increased to 39-10ths and the nipple regulator adjusted accordingly. An increase to 59-10ths reduced the duty to 1·085 litres per hefner (= 23·35 candles per cubic foot), and at 78-10ths the duty fell to 1·18 litres per hefner (= 22·31 candles per cubic foot). Thus, with careful regulation the inverted burner shows an increased duty up to 4 inches pressure; but at higher pressures the duty falls off.

(2) Use of Cast and Wrought Iron Pipes.

This branch of the Committee's investigations involved questions on which further information was imperatively called for. The Committee addressed a series of questions to gas and water undertakings asking for their experiences. The questions included, *inter alia*, the behaviour of cast-iron pipes on the one hand and wrought iron and steel pipes, which for particular purposes must be distinguished, on the other hand, both when used for street mains and for service connections. The information asked for was as to the lengths laid of each type of main and the diameter, the lapse of time since laying, the resistance to rusting and other chemical and physical effects, the relation of fractures to the different materials and sizes of the mains, the manner and cost of laying, and the manner of making the service connections. The immense volume of material which the replies to these questions present has led the Committee to decide to confine the investigation in the first instance to the results of practical experience, and to exclude for the present the scientific treatment based on chemical and physical investigation. Allied to this question is that of coating gas-mains inside with an asphaltic compound. The Committee give their report on this matter in an appendix [*vide infra*], and hope that it may interest wider circles, and lead to co-operation in the collection of further information.

(3) Outer Dimensions of Pipes, &c.

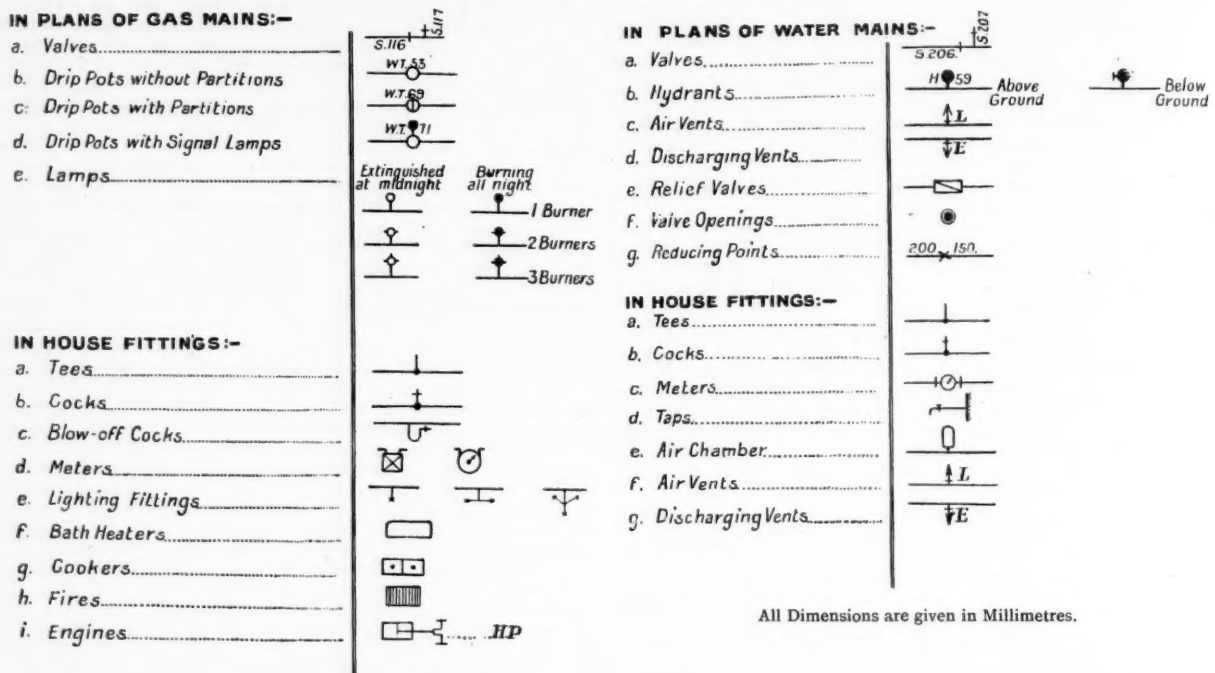
The Committee have tabulated the capacity for both gas and water per millimetre fall of pressure and per metre run of various sizes of steel and cast-iron pipes having the same external or nominal diameter. The increased capacity of steel and wrought-iron pipes offsets their increased cost per foot run. The Committee propose to collaborate with the Standards Committee on the question of the revision of the dimensions with a view to securing uniformity in different kinds of pipes. The work carried

on by Sir William Lindley, as Chairman of the Standards Committee, is already far advanced. He is in favour of standardization according to outer diameters; the formula $D_1 = 1{\cdot}04\ D + 10$ giving an appropriate range of sizes based on the outer diameter. The two Committees are deliberating on this question with the representatives of pipe and tube works; but the deliberations are not yet concluded.

(4) Uniform Signs and Colours for Plans of Mains.

It was at first thought that the schemes of other Technical Associations could be adopted—*e.g.*, (*a*) the specification of the Association of German Engineers for uniform colouring for mains and pipes in industrial works; (*b*) the similar specification for central heating and ventilation installations; and (*c*) the specification of the Institution of German Electrical Engineers for high-tension installations. These specifications do not apply to drawings, but merely for the recognition of works' mains. Moreover, the colours adopted are not practicable in all cases for drawings. While recognizing the advantage of agreement with other Associations, the Council of the Association thought that it would be best to adopt a special scheme having regard to the special conditions which prevail in gas and water works. A circular letter of inquiry to gas and water undertakings resulted in much valuable information being collected. This has been worked up into a scheme which is given in an appendix.

The chief features of this scheme are that gas-mains should be coloured red, water mains blue, sewage pipes brown, and electricity conductors yellow. The signs recommended for adoption are shown below:



All Dimensions are given in Millimetres.

SIGNS FOR PLANS OF GAS AND WATER MAINS.

Bituminous Coating of the Inner Walls of Mains.

The Instructional and Experimental Works have reported to the Committee on this matter, and the following particulars from the report are quoted:

Last year an increasing number of instances occurred of thick tarry material being pumped from the syphons of gas-mains, and this could not be attributed to condensation. It was suggested that the material came from the solution of the inner bituminous coating of mains. The results of analyses of the material removed from the syphons, and of similar analyses of the normal condensate found in such syphons, are given in a table, which shows clearly that the abnormal tarry material contained a relatively very high quantity of high boiling and non-volatile constituents, whereas the middle oils were wholly or nearly wholly lacking. It is very improbable that the high boiling hydrocarbons are transmitted in large quantities into the mains. Further, the tarry material contained much free carbon and ash, which likewise pointed to the bituminous coating of the mains having been dissolved and removed from them.

The coating is applied to mains by dipping the pipes when heated to about 150° C., into the molten pitch. The pipes are thus coated inside and outside; the surplus pitch being run off by placing the dipped pipes in an inclined position. In order to render the coating uniform and not too thick, a hot stream of air is sometimes blown through the dipped pipes. The mixture or pitch which is used for the coating is generally a secret composition. It is not clear whether natural asphalt was actually used in early times, and when, and to what extent, the pipe-works generally took to the use of coal-tar pitch. The experiences of the last few years show, however, that the coating of tubes in a great number of cases is no longer done with asphalt or asphalt varnish, but with coal-tar pitch. The importance of this lies in the fact that the tar coating is to a large extent soluble in benzene and hydrocarbons of the benzene series, but is insoluble, or only slightly soluble, in petroleum spirit; whereas true asphalt varnish is only slightly soluble in benzene, and is highly soluble in petroleum spirit.

The solubility of coal-tar pitch in benzene hydrocarbons causes the coating to be softened by the vapours of benzene and its homologues present in the gas. The coating is hygroscopic, so to speak, towards these vapours. As a consequence of these experiences, certain large works have for some time past been using either uncoated tubes, and themselves coating them outside, or have stipulated that the tubes are to be coated only outside by the makers. Many works use, instead of the customary tar asphalt varnish, petroleum tar which closely resembles natural asphalt in its chemical properties.

Work on this question will be continued, and it is hoped that, notwithstanding the secrecy maintained as to its composition, the material used by the pipe makers for coating the pipes may be obtained for examination. The Instructional and Experimental Works would be grateful for samples from gas-works in which observations of the kind described have been made, and especially for samples of old pipes in which the coating has remained well preserved notwithstanding the considerably higher proportion of hydrocarbons which the gas formerly contained.

The report is signed by Herr M. Hase, the Chairman.

III.—WATER WORKS.

The report of this Committee, which is signed by Herr Reese, of Dortmund, as Chairman, states that their work in the past year has been largely directed towards altering the scheme of the statistics of German water-works which are issued by the Association in order to reduce the cost of their publication. This alteration involves a very considerable reduction of their contents, which will thus lose value. A scheme, which it is hoped will be approved, has however, been evolved, by which the cost will be kept below the limit decided upon; while in future, statistics, as full as those hitherto published, will be issued at intervals of five years.

Questions asking for information for the twenty-fourth issue of the statistics were sent out to 488 water undertakings, and replies were received from 405, compared with 401 in the preceding year. The resultant statistics will be published very shortly.

An Imperial Order, extending the provisions relating to the standardization of water-meters, appeared to make standardization obligatory. The Committee communicated with the Imperial Standards Committee and learnt that the fees fixed in the Order referred only to optional standardizing of meters. Since compulsory testing and stamping of water-meters would have imposed a very heavy burden on water undertakings, without securing any commensurate benefit, the reply of the Standards Committee is regarded as highly satisfactory.

Dr. K. Bunte, as General Secretary of the Association, issued a circular of inquiry to water undertakings regarding the quality of the water supplied. The results of analyses which were received

in replies from 309 towns have been brought to a common basis, and are tabulated in an appendix to the Committee's report. Figures of importance, however, which are missing from most of the analyses reported, are those for free carbonic acid, oxygen, and iron. It is intended to repeat the inquiry from time to time, and to ask for further details, as the figures provide much information of general interest. Special attention is drawn to the reports from towns in which the water is exposed to the waste products of the potash industry, which industry it is felt should be made liable to render the water innocuous.

The Committee ask for a grant to cover the expenses of their work, and of the publication of the twenty-fifth volume of water-works statistics in the ensuing year.

The appendix, giving analytical results showing the quality of the water supplied in 309 German towns, states the following particulars for most cases, all in parts per 100,000: (1) Residue on evaporation; (2) residue on ignition; (3) total hardness; (4) permanent hardness; (5) lime; (6) magnesia; (7) sulphate; (8) chlorine; (9) oxygen consumption; (10) nitric acid.

IV.—WORKING OF GAS-WORKS.

The report of this Committee, which is signed by Herr F. Reese, of Dortmund, as Chairman, states that the Committee have held two meetings in the past twelve months, at which the chief business has been the production of serviceable statistics of gas undertakings.

Herr Göhrum, of Stuttgart, had written to the Association suggesting fundamental changes in the statistics of gas-works as hitherto issued. He considered these changes essential, in view of the progress made by electricity undertakings. The changes he proposed referred more especially to the inclusion of particulars of the capital charges and the prime cost of gas. The Committee are of opinion that the particulars suggested by Herr Göhrum would be of great service to the industry, but think that at the time the widely-divergent methods of book-keeping and profit reckoning adopted by various gas undertakings preclude the collection and recording of such information on a uniform or comparable basis. The adoption of a uniform simple scheme for the preparation of the annual balance-sheet and profit and loss account, on commercial lines, appeared to be an essential preliminary to the compilation of statistics covering the ground to which Herr Göhrum referred.

The Committee requested a Sub-Committee, consisting of Herren Hase, Kobbert, and Göhrum, to draw up such a scheme on practicable lines, to test it by the annual reports of works, and submit it for consideration. The Sub-Committee have recommended a scheme of which the principal headings are: (1) Receipts—viz., from the sale of gas, including public lighting, from the sale of bye-products, and from the sale or letting-on-hire of gas-meters; (2) expenditure, including total manufacturing charges, cost of coal, wages, &c.; (3) total cost of plant; (4) book value of works; (5) liabilities; (6) depreciation allowances. It is anticipated that the recommendations of the Sub-Committee will be ready for presentation to the Council at an early date.

V.—PHOTOMETRIC.

The report of this Committee, which is signed by Dr. P. Eitner as Chairman, relates the history of the transformation of the International Photometric Committee into the International Commission on Illumination. At the meeting of delegates from different countries, which was held at Berlin in August last, under the presidency of Professor Vautier, of Lyons, the German Association was represented by Dr. K. Bunte, Professor Eitner, Dr. Krüss, and Professor Drehschmidt.

The Photometric Committee of the Association was represented by Dr. Krüss at the meeting of the Committee of the German Illuminating Engineering Society at Berlin in November last. The work of Section II. (Nomenclature) and Section III. (Photometric Methods) of this Society falls largely within the range of the activities of the Photometric Committee, the whole of the members of which were present at one meeting, and two members at another meeting of Section III.; while Professor Eitner has attended the two meetings which have taken place of Section II. The deliberations of Section III. first resulted in the formulation of the following definitions, which on the motion of the Committee of the German Illuminating Engineering Society have been accepted by the German Association of Gas and Water Engineers and the Institution of German Electrical Engineers.

> *Evaluation of Sources of Light* (Special Lamps Excepted). A source of light is to be evaluated through one of three quantities—viz., (1) Mean spherical illuminating power (J_O); (2) mean lower hemispherical illuminating power ($J_{\supset}$), or mean horizontal illuminating power (J_h). Every statement must clearly indicate which of the three quantities is intended.
>
> From the purely physical standpoint J_O is the most important illuminating power. On practical grounds it is not generally feasible to give up the evaluation by $J_{\supset}$ or J_h, which has hitherto been customary.
>
> It is therefore recommended that there should be added to the figures for $J_{\supset}$ or J_h the factor for their conversion into J_O.

The deliberations of Section II., dealing with nomenclature, have not yet led to any definite conclusion. Much of the work of the Photometric Committee is closely allied to that of Sections II. and III. of the German Illuminating Engineering Society. This being especially the case with the preparation of prescriptions for photometry, this work has been advanced a great deal by joint effort during the past year. The drafting of these prescriptions is now far advanced, and it is anticipated that they will be ready in the course of the ensuing year.

The Committee have ascertained the views of manufacturers of lamps and glassware on the question of the standardization of the dimensions of parts of lamps, and have gone into the matter thoroughly with them. Agreement in principle has been come to; but the opinion was expressed in several instances that quite trifling alterations in the dimensions of more or less subsidiary parts of lamps might have a highly unfavourable effect on the duty of the lamps. It may, however, be anticipated that the further efforts of the Committee will result in a satisfactory solution, as already intermediate dimensions have been accepted in some cases, and there is general approval of the idea of standardization or unification.

VI.—THE INSTRUCTIONAL AND EXPERIMENTAL GAS-WORKS.

The work done at these works increases greatly from year to year, and the range of work has also extended far beyond that of an experimental gas-works having for its primary object the examination of gas coals generally used in Germany. Tests of apparatus for the use of gas occupy the works more and more, and the space originally provided with other objects in view is proving inadequate to an increasing extent.

The value of an independent and impartial institution for such examinations was so evident to the Council of the Association that they approved of further expenditure on an extension of the laboratory accommodation. On the recommendation of the Committee of the Instructional and Experimental Works, it was decided, in December last, to apply about £1150 on extensions, and to approach industrial undertakings connected with the gas industry for funds for the equipment of the new rooms. An appeal for funds for this purpose has already met with very gratifying response, which it is hoped will be followed by further contributions in order that the new rooms may be equipped in a manner in keeping with the requirements of scientific investigation of the questions to be dealt with. It was particularly desirable that the rooms should be provided with electric current for many experimental purposes, and also with central heating plant which might be used for the testing of various fuels. A room with thermostatic control of temperature for tests of gas-fires and other heating appliances was also imperatively required. In order also that the works might have an annual income in keeping with the wider scope of work which it now undertakes, the Council of the Association decided to solicit contributions in order to strengthen its financial position. About £600 has been contributed annually by gas-works; and last year the Association voted a sum of £250 to the institution. But these funds are very small compared with those at the disposal of other institutions of a similar kind. The request for increased contributions has already met with a gratifying response; and even in cases where the municipal authorities have been unable to vote a grant to the works, the importance and value of its work have been freely acknowledged. It may be anticipated from the responses that the works will in future have an assured income of about £1250 per annum.

These means will enable the works, in the first place, to undertake investigations on apparatus for the use of gas in a comprehensive manner. It is hoped to be able to increase the permanent staff of the laboratory with a view to carrying out prolonged investigations. Hitherto the works have been, to too great an extent, dependent on the self-sacrifice of its assistants. The extensions of the works will have about the same area as the previous laboratory, and will provide the following rooms: On the entrance floor, a laboratory for qualitative and quantitative chemical analyses and for testing apparatus of different kinds, an assistants' room with library, and a small laboratory. In the basement, a large cellar, about 34 ft. 6 in. square and 11 ft. 6 in. high, in the centre of which will be constructed a room of 3500 cubic feet capacity, which will be surrounded on all sides by the cellar space which will remain tolerably uniform in temperature. The central room is to be equipped as a thermostatic experimental room for heating tests. The upper floor will provide an extension of the photometer room and of the preparation room, and a room in which gas appliances, gas-cookers, &c., can be tested. This room can also be used in case of need for further lengthening the photometer room.

The trend of the work undertaken by the works in the past year may be gathered from the following references to some of its more interesting features: A large number of pits have asked the works to include their coals among those examined. Some were well-known kinds not hitherto tested; others had been tested some time ago and re-testing seemed desirable, while others were from newly-opened pits. Among the coals tested were three English—viz., Lambton, Old Pelton Main, and Denaby, which had been supplied for testing by gas undertakings. An interesting investigation has been completed, of the effect of storage of a large bulk of coal from the Königsgrube mine, in sheds and in the open, for 2½ years. In each case 10 tons were tested before and after storage; and a report on the results was given in the "JOURNAL" for May 19 last, p. 494.

Two samples of gasholder water were examined with a view to

ascertaining if they would have any harmful effect on life in streams. One of them was cloudy with suspended matter. It contained in solution cyanogen compounds equivalent to about 2 parts of hydrocyanic acid per 100,000. Insoluble cyanogen compounds in the suspended matter were equivalent to a further 40 parts per 100,000. Though insoluble, it may be surmised that they would be broken up in appreciable quantities by the digestive processes. In the other case direct tests were made before running off the water as to its effect on fish. The holder water, which was fairly clear, contained 3·1 parts per 100,000 of ammonia, but no perceptible amount of cyanogen or sulphocyanide. Fish remained for 24 hours uninjured in water to which 10 to 25 per cent. of this holder water had been added. With 50 per cent. of the water, gold fish remained for half-an-hour without being seriously affected. After being in the undiluted holder water for a quarter of an hour, they were very restless, but recovered when transferred to clean water. It was concluded from the experiments that, having regard to the subsequent dilution in the stream, it would be sufficient to dilute the holder water with an equal volume of clean water before discharging it.

Samples of oxide purifying material were tested by taking 20 grammes of the air-dried material, moistening it, and transferring it to a Soxhlet extractor over glass wool. It was then saturated with sulphuretted hydrogen, and without removal from the extractor revivified by moist air, dried in a current of dry air, and extracted with carbon bisulphide. The sulphur was then weighed directly in the comparatively light Soxhlet flask.

A peculiar solid deposit of coherent flaky crystals, which almost completely blocked the condensers in one works to a height of 40 inches, was examined. It was free from tar, and its composition corresponded very closely indeed with acid ammonium carbonate (NH_4HCO_3).

The "Sarco" gas calorimeter has been examined, and the report on it published. Graefe's gas calorimeter has been found, even with very careful working, to be subject to errors of $\pm$ 1·5 per cent. It cannot therefore be recommended for the precise control of calorific power on gas-works. Some investigations have been made on the calorimetry of rich gas, such as natural gas, oil gas, &c., and the results will be reported later.

Two appliances for recording the specific gravity of gas were examined—one being the Simmance and Abady and the other the hydro. The latter apparatus depends on good principles, and no doubt the small mechanical defects which appeared in the specimen examined can be overcome in later specimens. With gas of specific gravity falling within the usual range of ·35 to ·45, the readings are generally concordant within 2·5 per cent.

Investigation has also been carried out on the question of the saturation of gas with water vapour on its passage through wet meters and similar apparatus. A report on this question has been published in the Technical Press.

A stereopyrometer has been examined. In it glass cells containing dark liquid are placed in front of the eyes and absorb the light from the source under examination, and darker or lighter cells are used until the light transmitted is equal to a standard. The cells represent intervals of 50° in temperature, and as only two pairs of cells can be placed in the apparatus at one time, the range of temperature which may be measured, with an exactness of at most 50°, is only 100°. The apparatus does not seem well adapted to gas-works purposes.

The sources of errors in dry meters were investigated, and as a whole resolved themselves into two questions—viz: (1) Oil residues in the meters causing the meters to be slow; and (2) want of uniformity of action due to sticking of the valves. Oily residues from meters were generally not collected in sufficient quantity for quantitative examination; but in one case some dark brown oil removed from a meter gave off on distillation uncondensable vapours up to 90° C., 10·8 per cent. of light tar hydrocarbons up to 180° C., 19·7 per cent. of heavier tar hydrocarbons, perhaps with some mineral oil, up to 240° C., and 44·3 per cent. of heavier oils up to 360° C., containing fatty oils which on decomposition gave vapours of acrolein. These results indicate that the grease with which the membrane had been impregnated had been extracted by benzol vapours, &c., condensed from the gas. In another case the deposited liquid on heating gave an unmistakable smell of burning resin. The resin had doubtless been left by the solderers and had been dissolved by the condensed vapours. It is proposed to extend this work by investigating the effect of the hydrocarbons of gas on the usual impregnating agents.

Investigations of methods of gas analysis have been made—especially the method of Dr. E. Czako, of the Kaiser Wilhelm Institute for Coal Research. Reports on this work will be published shortly, and also on the fractional combustion of hydrogen and marsh gas with copper oxide over water and glycerine.

Several analyses of natural gas have been made. The Neuengamme natural gas (of which a supply is taken to Hamburg for mixing with the town gas) in July, 1913, was found to contain a trace of carbonic acid, 95·3 per cent. of methane, 1·5 per cent. of ethane, and 3·2 per cent. of nitrogen, and to have a specific gravity of ·574 and a gross calorific power of 885 B.Th.U. per cubic foot at 60° Fahr., 30 inches, and saturated. The composition of the gas is practically identical with that of a sample examined in December, 1911. Photometric tests with ordinary and special burners consuming this gas were made, and were found to give a duty of from 0·606 litre to 1 litre per hefner (= 41·8 to 25·3 candles per cubic foot). The best duty of all was obtained with the Otepe natural-gas burner, and the lowest with the Windemuller upright coal-gas burner. Natural gas from the Frankenholz mine, which is used for industrial purposes, was also analyzed, and was found, when free from air, to contain 97·3 per cent. of methane, and to have a specific gravity of ·587 and a gross calorific power of 865 B.Th.U. per cubic foot.

The photometric work carried out included tests of seven new patterns of burners. Of these, the most interesting was Killing's "Mundus" light, which at a pressure of 22-10ths to 23-10ths, with a simple chimney, gave most light vertically downwards, and in this direction showed a duty of about 36 candles per cubic foot, with no perceptible falling off up to 100 hours' use. Tests were also made of Schanzenbach's Lamella reflectors, which, with a 300-candle power Mannesmann lamp, increased the light directly downwards by 60 per cent.; while the horizontal illuminating power fell to about one-third. The average of the total hemispherical illuminating power was lowered by the reflector. A number of makes of mantles have been tested for durability and resistance to shock—sixteen specimens of each make being used. The average decrease of illuminating power in 400 hours' use with four makes was as follows: A, 2·9 per cent.; B, 6·2 per cent.; C, 6·1 per cent.; D, 16·5 per cent. The last named showed very poor resistance to shocks. None of the makes are considered to have behaved in the tests as first-class mantles should have done; and the importance of checking specimens from all large consignments is emphasized by the results.

A series of tests on gas-cookers has been carried out on lines agreed upon by a Joint Committee; but the results are not yet ready for publication. Investigations were also made, by request, to determine suitable dimensions for a gas-cooker intended for use with brown-coal or lignite gas. Gas having a net calorific power of about 370 B.Th.U., and containing appropriate proportions of carbonic acid and nitrogen, was prepared to resemble such gas, and the sizes of nipple, bottom of kettle, and burner spacing were varied until an efficiency of 54 per cent. was obtained, with a boiling time of 17½ minutes and a rate of consumption of about 18 cubic feet per hour. A boiling-burner, having a plate inserted in the mixing-tube, in order to adapt it to the consumption of coal gas at high pressure, was tested with the result that it was found that the efficiency was in any case low, but that the plate effected some improvement. A reduction of the distance between the burner and the kettle, however, caused a much greater improvement in the efficiency.

Investigations which have been made on gas-fires are dealt with in a separate communication by Dr. K. Bunte [*ante*, p. 28]. Bath water-heaters have also been investigated, especially in regard to the effect of pressure and calorific power of the gas on their liability to form soot.

Incidentally the report mentions that quartz crucibles, &c., have been found a useful substitute for platinum in technical analyses. Investigations made at various gas-works have taken members of the staff away from the Experimental Works for a total of 251 days during the year. Such visits, however, help to keep the staff in touch with practical working. Instructional work included a gas course of two weeks' duration which was attended by 28 pupils. It is hoped that the extension of the works will be ready for use this autumn.

SAFETY DEVICE FOR GAS-METERS.

At the recent Congress of the Société Technique, M. Visser brought under the notice of the members a safety device for gas-meters which has been patented by Heer Rutten, of The Hague, and is extensively used in Holland. The appliance was presented by the Compagnie des Compteurs.

The problem which Heer Rutten set himself, and which he has successfully solved, was to leave at the disposal of consumers, during the hours of sleep, a limited quantity of gas—sufficient to meet the requirements of nocturnal consumption, but too little to cause, in the event of an escape, an accident of any kind—and also prevent all danger of leakage by the working of a suitable safety device. This consists of two distinct appliances, which are shown in fig. 1. One is placed on the inlet to the meter, and limits the quantity of gas which can be delivered while the apparatus is working; and the other, fixed on the outlet, is a safety-valve intended to prevent the inconveniences which might result from a consumer forgetting to turn off the cock when the meter is restored to normal service, and working automatically in case of an escape in the house service-pipes.

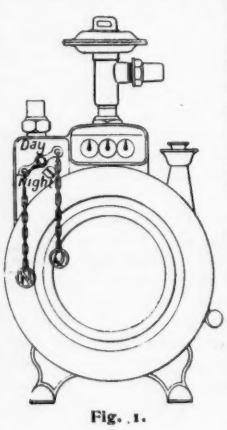


Fig. 1.

The appliance for the inlet is shown in detail in fig. 2, and its action is as follows: Before retiring for the night, the consumer moves the chain lever (fig. 1), and places the indicator on the word "Night." Movement of the lever C (fig. 2) is transmitted to the eccentric D, which then rotates on its axis. The effect is to make the toothed rod E, on being pushed upwards

by the spiral spring shown, gear with the wheel F. The rod is then subjected to a horizontal displacement from right to left, which brings its extremity into contact with the head of the valve G, which regulates the admission of the gas, and completely closes the inlet when the rod has moved a sufficient distance.

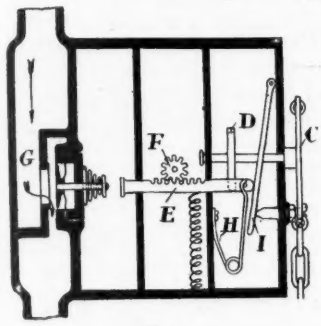


Fig. 2.

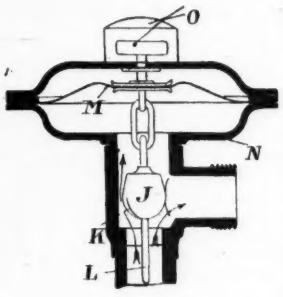


Fig. 3.

To restore the normal intake of gas, the consumer moves the chain lever, and thus brings the indicator on to the word "Day." The chain lever thus rotating for a quarter turn, the eccentric D acts on the toothed rod, which disengages itself from the wheel. Actuated by the spring H, the rod moves horizontally to the right until its extremity comes into contact with the plate I. The spring wound around the valve-rod brings the valve back to its initial position, and the gas again passes freely. The displacement of the toothed rod is governed by means of a screw; and consequently the quantity of gas which can be exceeded during the night is limited to (say) 50 to 350 litres (1·7 to 12 cubic feet), according to needs.

The outlet appliance (shown in detail in fig. 3) consists of a valve J, provided with a groove K and a rod L suspended by rings to a membrane M fixed with a hoop on a box N. This box is closed with a lid perforated with a small opening to allow the air to escape. An indicator O, having upon it the words "Gas" or "No Gas," is placed above the lid, and worked by the higher part of the membrane. When there is no pressure in the service-pipes, the membrane is lowered, and the valve J rests on its seat. When the pressure of gas is exerted underneath the valve at the outlet of the meter, the gas enters the service-pipes through the groove K; but this groove is so regulated that the quantity of gas which can pass into the pipes does not exceed 20 litres (0·7 cubic foot) per hour. If there is no leakage, the pipes inside the house gradually get under pressure, the membrane M is raised, the valve J is moved, and gas enters freely. In the opposite case, the membrane remains down, and the valve prevents the passage of gas. The quantity of gas which can then enter the service-pipes remains fixed at a maximum of 20 litres an hour. There must be a pressure of 6-10ths in the pipes to make the membrane work.

The Company who construct Heer Rutten's appliance in Holland have installed more than 6000 of them in a few months. This affords proof of their satisfactory working.

MAKING CONNECTIONS ON CHARGED MAINS.

It may be remembered that at the congress of the Société Technique du Gaz at Toulouse last year the attention of the members was directed to a machine for making connections on charged gas-mains, devised by M. Grange, the foreman plumber in the service of the Toulon Gas Company. It was described and illustrated in the "JOURNAL" for July 15, 1913 (p. 170). At the recent congress of the Society in Paris, M. Bachelay, in a short paper, brought to his colleagues' notice the Poirson-Lamachia system, the purpose of which is similar to that of M. Grange. It will allow of connections of all diameters up to 3¼ inches being made on charged mains without loss of gas, and consequently without the workman or the inhabitants of neighbouring houses being inconvenienced.

Some modifications of the machine have been made by M. Combe, who has succeeded M. Bachelay as Manager at Toulon, where it has been in use almost daily for five years. It is shown in the accompanying illustrations; fig. 1 being an elevation, fig. 2 a section, and fig. 3 a plan.

The appliance consists of a cast-iron collar held upon the pipe by an iron stirrup A, and carrying a clamp allowing of a lead junction being made by the aid of a collar and a counterclamp. Two symmetrical jaws B surround the flange of the collar, and can be pressed against it by the aid of bolts C. The jaws have a slot, in which an obstructing plate D, having in it a hole for the passage of the drill, can move. The cutter consists of a bronze tube of two diameters. The lower and larger one E, forming a chamber for holding the drill, terminates in a shoulder F, which serves to fix the appliance upon the collar by means of the two bolts G. The upper chamber H carries a threaded sleeve K, actuated by a wheel L, whereby the cutter is made to descend. A stuffing-box J, in the position shown, ensures elasticity; and a ball-bearing M eases the descending movement of the drill.

The method of using the appliance will be apparent from an

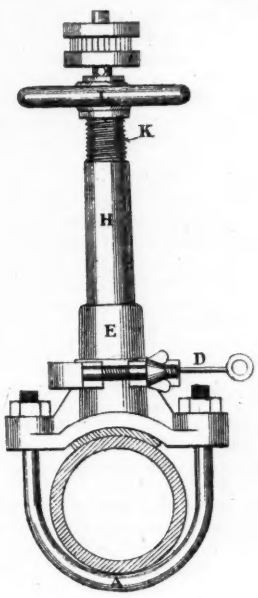


Fig. 1.

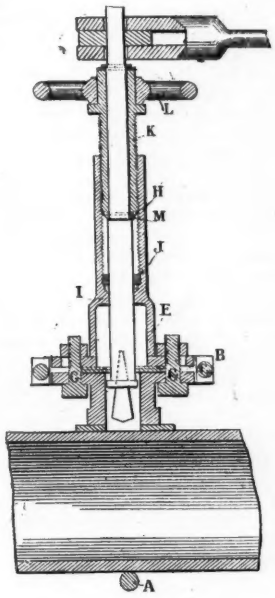


Fig. 2.

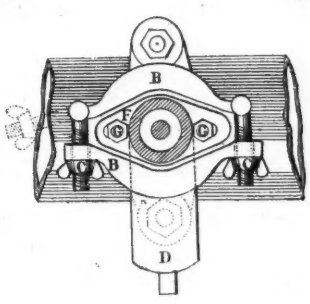
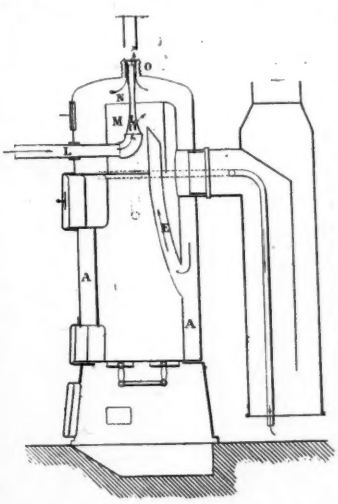


Fig. 3.

inspection of the illustrations. It consists in mounting the cutter on the collar, drawing the plate D, cutting the pipe, and closing the plate. All that is necessary afterwards is to substitute the source-pipe for the cutter, and, by releasing the jaws, remove the plate and complete the job.

CENTRAL HEATING WITH A COKE-BOILER.

In the article on the gas appliances at the Lyons Exhibition which appears in another part of the "JOURNAL," an illustrated description is given of the Clamond gas-boiler, constructed by the Société Chaleur et Lumière. The Company have also produced one on the same principle for coke, which can be employed for the heating of flats, and be installed in the same way as radiators; and it was described by M. Gaunard at the last congress of the Société Technique du Gaz en France. This system of heating with hot water is daily being much more extensively adopted; and it seems to be preferred, by landlords and tenants, to steam heating.



The boiler is constructed of steel plate on a cast-iron pedestal, with a water-jacket A and a series of water-tubes E running across the furnace, and bringing the ring of water into communication with the boiler dome, in which an emulsionizer is placed. The latter is constituted by the prolongation of the return pipe across the dome. This pipe ends in a delivery-pipe of a truncated cone shape L^1, perforated at the base with openings M, and terminating a little below the branch of the starting-pipe O. The boiler is connected by the latter pipe with an expansion vessel on which the pipes running to the radiators are branched; and the return is at L, either by the floor or the ceiling. The furnace consists of a chamber of sufficient capacity to hold the fuel to be consumed

in 24 hours, with a hinged grate and all the ordinary adjuncts. A temperature regulator placed on the return pipe regulates, with a counterweight, the admission of air to the furnace. Some of the steam bubbles produced in the tubes E are not condensed by the return water in M. They escape by N, and cause a flow of water in the pipe O. There is then formed an emulsion in the rising column, soon followed by condensation; and the result is very intense circulation.

A boiler of 15,000 calories serving nine radiators with a total surface of 345 square feet worked during all last winter, consuming 66 to 106 lbs. of coke in two or three charges per 24 hours. The efficiency of the appliance was established by absorbing, in a calorimeter with water circulation, the heat units produced by the boiler. With the object of showing the accelerated circulation, the calorimeter was placed at the boiler level, and the return of cold water conveyed to the ceiling. With coke containing 9 per cent. of moisture and having a heating power, dry, of 7350 calories, the efficiency was 80·35 per cent. with a net consumption of 3¼ lbs. of coke per hour, or 62½ lbs. for each 10·75 square feet of grate. Analysis of the products of combustion gave 10 per cent. of CO_2, and 0·25 per cent. of CO. This proportion of CO is improved by means of an auxiliary air-intake device below the layer of incandescent coke. This air is heated by passing through a recuperator placed in the burnt gas conduits.

M. Gaunard mentioned a plant consisting of eleven radiators, with a total heating surface of 577 square feet, constructed at the Angers Gas-Works for heating the offices. The boiler, of 35,000 calories, consumes daily in three charges something like 5½ bushels of small coke.

A VOLUMETRIC PRESSURE-RAISER.

One of the members of the Société Technique du Gaz—M. Mazeron—set himself the task of constructing a pressure-raiser for gas or air, capable of rotating at the normal velocity of electric motors, and consequently of being connected directly with them; and he described it in a paper submitted at the recent congress. It is shown in the accompanying illustrations.

The apparatus consists essentially of two shells A and A^1 joined together, and having between them a cylindrical space B. Two helicoidal pistons D, supported by a cylindrical boss E, turn concentrically around a shaft C. The space B is continued by a boosting branch J prolonging the circular passage formed by the two half-shells and the boss. By means of toothed gear, the shaft C entrains another shaft F, placed in the median plane of the half-shells, and the rotary speed of which is thus in constant relation with that of the shaft C. The shaft F is provided with a stopper G, consisting of a cylindrical ring, which, by resting on the boss and the half-shells, closes the annular space in which the pistons move. This stopper revolves in a chamber furnished with a suction orifice K. The stopper G has notches I upon it to allow the pistons to pass through at each revolution without causing any communication between the top and under part of the stopper. The incline given to the pistons and the notches is directed according to the component of velocities of these two parts. Thus the minimum of play during the passages is attained in this way.

The working of the machine is as follows: The pistons in turning draw after them the gas entering through the orifice K, and force it before them in the direction of the circumference as far as the outlet of the branch J. All the parts, being actuated by a continuous rotary motion, can revolve at high speed. It is possible, under these conditions, to allow a certain amount of play between the fixed and movable parts without fear of leakage, at the same time avoiding all wear. The efficiency of the machine varies from 0·656 to 0·720. It is stated that it gives better results when a certain amount of thick oil is put into the shells. Consequently its employment may be looked forward to for gas charged with tar—for example, as an exhauster.

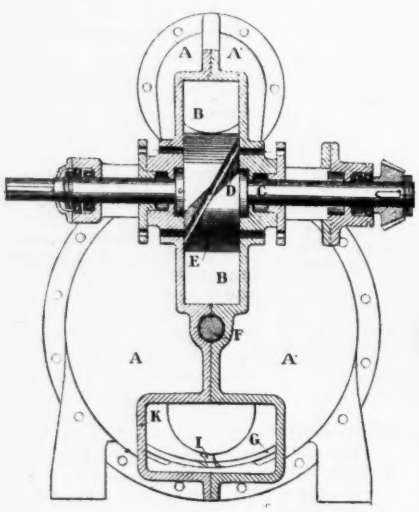


Fig. 1.

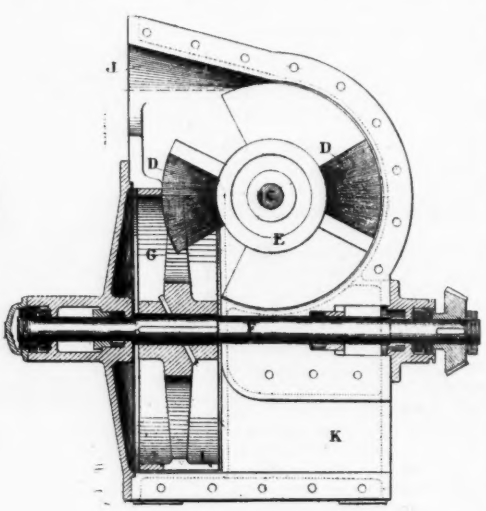


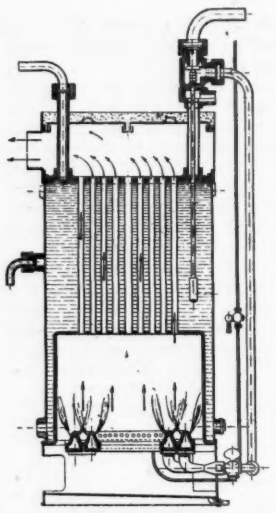
Fig. 2.

HOT-WATER DISTRIBUTION BY GAS.

Heating a large volume of water by gas for distribution in tenement houses has hitherto been little employed in France; nevertheless it affords an interesting opening for sales, and the problem can, in certain instances, be satisfactorily solved. To demonstrate the advantages of the utilization of gas for the purpose named, M. Frère, in a paper read before the Société Technique du Gaz, made a comparison between two hot-water services, one with boilers and coal used also for heating purposes during the winter time, and the other fed only by a distributor of the "Chaleur et Lumière" type, heated by gas.

In the case of the coal-fired boilers, the plant comprised two hot water boilers of sufficient capacity to ensure in winter both heating and the water service, while in summer the latter was obtained with a smaller boiler. The water for distribution was heated under pressure, in a tank by means of a worm, into which water ran from the boilers. Plant of this description, in a building of five floors, with six draw-off cocks (one of them for the bath-room) per floor and a total daily delivery of 580 gallons of water, heated from 10° to 70° C., has practically only an efficiency of 36 per cent., considering that the greater part of the hot water must be supplied in three hours, and reckoning loss of heat.

In the case of heating by gas, the hot water is prepared in a distributor having an efficiency of 86 per cent. It feeds the bath-rooms through a tank of 308 gallons capacity, and the draw-off cocks through one of 28 gallons. Inquiry into the consumption of water showed that during the period of great consumption (while baths were being taken), as well as in that of small consumption, the reserve of hot water should be respectively the quantities stated above; the boiler being able to produce per hour about 154 gallons of water heated to (say) 55° C. The final efficiency of such a plant, reckoning loss of heat by radiation, would be 77 per cent. The employment of a gas-heated hot-water distributor will therefore, according to M. Frère, result in very considerable economy, owing to its great adaptability and the rapidity with which it can be set to work.



The distributor referred to is shown in the accompanying illustration. It consists of a vertical tubular galvanized steel plate boiler, standing upon a cast-iron pedestal. The burner is of the multiple blue flame type, with independent pilot-light. It is placed in a large combustion chamber, where the flames cannot reach the walls; thus preventing formation of soot and calcareous deposits. The smoke-tubes are 0·8 inch diameter, and at the top run into a smoke-box which is within easy reach for cleaning. A liquid expansion regulator dips into the water in the boiler, and governs, through the agency of a valve, the delivery of gas. A safety-valve and a lead plug, melting at 110° C., give a guarantee against any defective working. These distributors are constructed for a production of 5250 to 6500 calories per square metre (10·76 square feet) of heating surface per hour with the greatest delivery of gas. This is better utilization than in ordinary bath-heaters.

Some trials made with the same apparatus at two different rates of working for the gas, corresponding to rises of temperature in the water of 55° and 34° C., gave, with a consumption of 46,700 to 51,000 calories per hour (about 370 and 247 cubic feet of gas), an efficiency of 85 and 87 per cent.; the delivery of hot water being 157 and 175 gallons per hour. The products of combustion, containing about 0·5 per cent. of carbon monoxide, escape at from 167° to 143° C.

THE EXAMINATIONS IN "GAS ENGINEERING" AND "GAS SUPPLY."

List of Successful Candidates.

THE pass-lists for the last examinations in "Gas Engineering" and "Gas Supply" have been sent by Sir Philip Magnus, M.P. (the Superintendent of Technological Examinations of the City and Guilds of London Institute) to the Institution of Gas Engineers; and they have been forwarded to us by Mr. Walter T. Dunn, the Secretary, for publication. The questions set by the Examiner in the first-named subject—Mr. Thomas Glover, of Norwich—were given in the "JOURNAL" for April 28, p. 275; and those put by Mr. Walter Hole, of Leeds, on "Gas Supply," will be found in the succeeding issue. The names of the prize winners will probably be announced in the course of a few weeks.

GAS ENGINEERING.

FINAL GRADE.

First Class.

Adams, Thomas E.
Allison, Harold P.
Ashworth, John D.
Baldwick, Kenneth W.
Bateman, Frank
Bateman, Henry L.
Brasington, Frederick T.
Bryant, Herbert C.
Butler, Thomas J.
Carpenter, William N.
Corder, Alwyne St. D.
Dagg, Richard
Davis, Joseph F.
Dearberg, Henry W.
Denning, Samuel T.
Escreet, Hubert J.
Ford, John E.
Gladstone, William E.
Gooch, William S.
Goodsir, Herbert
Gray, Percy
Greenwood, Herbert
Harvey, Thomas A.
Hester, James P.
Hulme, Humphrey
Humphrys, Leonard G.
Jacobs, Alfred F.
Johns, Tom V.
Jones, John W.
Kenshole, William T.
Law, Thomas
Manning, Albert H.
M'Lusky, James
M'Nicol, James S.
Meadway, Brian W.
Millington, Percy
Muir, Archibald R.
Murgatroyd, James
Onions, Robert E.
Padgett, Ernest G.
Pedding, Arthur H.
Pickles, Harrold
Pilbeam, Henry T. W.
Price, Conrad T.
Rudge, Tom
Scott, Edward H.
Shewring, Harold
Simpson, Robert M'D.
Surtees, Gilbert
Sutton, John E.
Wadsworth, Maurice
Warby, Ernest H.
Westworth, James K.
Witham, Frank M.
Yates, Arthur F.
Young, Donald

Second Class.

Arthur, Edward
Ball, William W.
Bearne, Paul O.
Bridger, Henry J.
Carr, John T.
Chapman, John H.
Clark, Richard G.
Clayton, John R.
Coe, Arthur
Cook, Albert
Cox, Harry C.
Davis, Albert H. D.
Elser, John S.
Felton, Colin B.
Fender, Lionel R.
Gibson, Walter S.
Greaves, John
Hallsworth, Frederick
Hamilton, George
Hardiker, Ernest
Hazel, Ernest R.
Hopper, Frederick E.
Imbrie, William J.
Inns, Charles H.
Kaye, Elliott
Kitchin, John E.
Lant, Gerald H.
Maxwell, Stanley C.
M'Donald, Robert B.
Millett, Thomas W.
Philpot, Herbert J.
Postlethwaite, W. H.
Prentis, Arthur E.
Rust, Joseph F.
Sumner, Horace R.
Thomson, Andrew
Tilson, Hedley V.
Tradewell, Clarence
Verity, Albert W.
Vickers, Charles E.
Warr, Raymond G.
Whitworth, William

GRADE I.

First Class.

Alexander, Bruce
Barnett, Walter A.
Beaumont, Leslie
Beebee, Frank A.
Booth, Alfred L.
Booth, James H.
Budd, James
Chadwick, John W.
Chaplin, Richard T.
Clark, Alan M'G.
Copland, Dudley C. J.
Davidson, Alexander N.
Dickinson, Robert J.
Duncan, Clifford
Duncan, James H.
Eve, Edgar W.
Fairclough, Herbert
Foxwell, Geoffrey E.
Gandon, Kenneth C.
Hoskins, William A.
Jamieson, James
Jones, Harry L.
Key, Andrew
Leonard, Arthur A.
Lord, Frank H.
M'Quillan, Arthur J.
Muddiman, Ernest W.
Nash, Edwin C.
Needham, Robert
Noble, John H.
Orme, Thomas J.
Rawston, Frederick B.
Rice, Cecil E.
Roos, Alfred
Sharpe, William
Smith, Sydney G.
Sutherland, Andrew
Thomas, Arthur J. O.
Thomas, Leonard H.
Thrale, Geoffrey
Tilley, Geoffrey
Valentine, Douglas
Weekes, Rodney C.
White, Francis
Young, Conrad

Second Class.

Banford, Frank E.
Barker, William
Beesley, Horace G.
Berry, Richard
Berry, Samuel
Black, Thomas
Brear, Bernard H.
Bridge, Harry
Buckley, Edward E.
Burnham, Thomas
Candy, Herbert E. L.
Carr, Robert
Claridge, Wilfred B.
Crockett, William M.
Davey, Leslie W.
Downsbrough, Ernest
Flegg, George H.
Galleway, Harold
Gilmour, James E.
Gould, Thomas L.
Hall, George
Hall, Harold
Havill, Frank
Heath, Ernest
Hems, Harold R.
Jacobs, Francis J.
Johnson, Henry
Knapp, Stanley R.
Loxton, Norman G.
Laycock, William
Morris, Arthur C.
Murray, Robert R.
Nalder, Lawrence M.
Norman, Colin
Parsons, George W.
Pilditch, Cleverton L.
Poulson, Joseph
Shaw, Fred.
Shaw, James S.
Small, Frank B.
Smith, Arthur L.
Spencer, Alfred
Tiffany, Tom S.
Tyther, Alfred H.
Waddington, Harold
Waterson, Richard
Wilson, Alfred C. W.
Wood, Robert G.
Woodfine, Cecil
Worthington, James

GAS SUPPLY.

FINAL GRADE.

First Class.

Ashworth, John D.
Baker, James W.
Barber, Herbert
Beebee, Frank A.
Bellamy, Frederick B.
Bennett, Henry J.
Beveridge, James
Broadbent, Arthur
Brown, James
Butterfield, John A.
Campbell, Herbert
Carney, John
Cobb, William
Cook, Alfred J.
Cronk, Leonard A.
Currier, George E.
Dallison, Francis H.
Davis, Samuel J.
Dieterichs, William
Duncan, Clifford
Edwards, Frederick
Godly, Albert G.
Gould, John A.
Hack, Sydney R.
Healy, John T.
Hepple, Frank
Highmore, Joseph G.
Holman, Frederick J.
Ironside, Alan S.
Javes, Robert C.
Kaye, Elliott
Linnell, George T.
Lovesey, Stanley E.
Matthews, William E.
Morrison, James
Padgett, E. G.
Page, James L.
Potter, Sidney J.
Richmond, Claude
Rowley, Walter
Rudge, Tom
Ruston, William C.
Sturdy, Luke
Taylor, Frank G. H.
Whitehead, Sidney E.
Willsmer, Norrie
Wilson, David H.
Winslow, David J.
Young, Conrad

Second Class.

Adams, Thomas E.
Allison, Frederick
Arthur, Edward
Atkins, William P.
Badger, Edward A.
Bateman, Henry L.
Bellamy, William
Billingham, Arthur D.
Bridge, Harry
Brooke, Edgar
Broomhall, Edwin F.
Byrne, Edward T.
Cæsar, Augustus
Calvert, Edward E.
Canlett, Frederick R.
Christmas, Ernest V.
Church, Ernest H.
Cottle, Ernest A.
Cotton, Ernest J.
Cutler, Arthur H.
Dadson, George H.
Driver, Morris
Elsworth, Sidney
Evans, Edward
Felton, Colin B.
Fevyer, Ernest W. J.
Foden, Sidney
Freeth, Henry A.
Gash, George
Gaskell, John H.
Haley, Henry
Hazel, Ernest R.
Hester, James D.
Hogg, William
Homersham, Edwd. W.
Howard, William N.
Humphries, Arthur W.
Jones, Hugh
Knight, George H.
Lambert, Thomas
Lamond, Alexander W.
Langford, Percy S.
Lilly, William
Long, Arthur
Longstreeth, Percy D.
Lowe, William A.
Mabey, Francis A.
Marsh, Thomas
Millington, Percy
Millner, Frederick
Morgan, Edward W.
Muir, Archibald R.
Needle, Albert E.
Norton, Douglas
Page, Alfred T.
Parker, Frederic C.
Pateman, Frederick C.
Perry, Thomas
Peters, Alfred G.
Portsmore, Herbert
Price, Howard W.
Priest, Clarence E.
Purkis, Hubert S.
Quelch, Stephen J.
Reeder, Sidney E.
Reynolds, Robert A.
Richards, Cyril
Rivers, Ernest
Roberts, Arthur
Roberts, Frank
Robson, George W.
Rudge, John
Rust, Joseph F.
Schreiner, Edwin H. C.
Shackleton, Edward
Sheppard, Charles H.
Short, Alfred J.
Short, Leslie F.
Sly, Herbert F.
Smith, Charles H.
Smith, Ernest F.
Smith, Lionel S.
Squires, Ernest H.
Stanley, Horace R.
Stringer, Alfred W.
Sturney, Charles
Sumner, Leonard G.
Thale, Geoffrey
Thorburn, Ronald D. V.
Thorn, Harry
Tuck, Percy
Warby, Ernest H.
Webber, Wilfrid G.
West, George W.
Wheeler, Ernest J.
Whitehead, Albert
White, Hedley G.
White, Robert J.
Wilbraham, George H.
Williams, John
Williamson, Harold
Wolfe, Thomas A.
Woods, Alfred C.
Yates, William M.

GRADE I.

First Class.

Abbott, Allen
Akerman, Edwin J.
Allen, Charles
Allen, Frederick J.
Anderson, Joseph C.
Ashwood, Francis W.
Atherton, James
Atherton, William
Bates, John W.
Bailey, Edward
Baker, Frank L.
Ball, William W.
Barker, William
Barnes, Howarth
Barnes, Joseph
Barnett, Harold
Barton, Clement J.
Baxendale, Fred J.
Beaumont, Leslie
Beesley, Horace G.
Bedingham, Albert
Bellmain, Lewis V.
Bewshir, Bryan
Black, Thomas
Bleach, George W.
Booth, James H.
Brear, Bernard H.
Bristow, Herbert L.
Broadfield, Fredk. E.
Brown, Harry C.
Brown, William
Callow, James
Candy, Herbert E.
Carr, Robert
Carreck, William A.
Chable, George
Chadwick, John W.
Champion, Alexander J.
Christie, Frederick G.
Church, Arthur A.
Clayton, Hubert A.
Cooke, Edgar L.
Cooper, Albert W.
Cooper, James F.
Crowther, Percy L.
Crummenauer, P. H.
Cummings, Albert
Dagg, Richard
Davidson, Alexander
Davidson, Henry H.
Davy, Thomas H.
Day, Alfred H.
Dey, Herbert
Downton, Ernest M.
Draper, Albert E.
Duxbury, James B.
Eastham, John H.
Edwards, Alexander O.
Elphick, Charles A.
Evans, Joseph L.
Evans, Llewellyn
Fairclough, Herbert
Faithful, Cecil W.
Field, Gordon S.
Filby, George
Fitch, Arthur J.
Ford, Ernest
Ford, George
Fotherby, Robert C.
Furminger, William
Gamble, Joseph
Garcia, Cecil F.
Gardener, Arthur
Geall, George
Gilding, Frederic
Gladstone, William E.
Gould, Frederick W.
Graver, Alfred W.
Green, Henry H.
Green, Reginald G.
Griffiths, Thomas
Griffiths, William J.
Gunner, Leonard W.
Hale, Henry J.
Harling, Frank W.
Harriss, Charles
Harrison, Norman H.
Harrison, Sidney J.
Harris, Thomas W.
Haynes, John B.
Heath, Ernest
Hector, Albert
Hems, Harold R.
Henning, Percival
Heuser, Frederick
Hevey, Arthur
Higgs, Hermon G.
Higgs, John N.
Hiscock, Reginald J.
Hisson, Ernest S. W.
Hitchcock, Arthur
Holmes, George
Holmes, James
Hopkins, Frank J.
Horn, Percy W.
House, George
Howarth, Harry
Humphries, Horace P.
Isaacks, George E.
Jackson, Thomas
Jackson, Walter P.
Jamieson, James
Jenkins, Ifer G.
Jones, John W.
Jones, Thomas
Kay, Arthur J.
Kay, Thomas
Kemp, William A.

Kerry, Robert S. A.
Kirkbride, Herbert D.
Knapp, Percy
Lancaster, Charles A.
Lathrope, Frank H.
Lavender, William G.
Lawden, Frederick E.
Leacy, Peter H.
Leggett, John R.
Leonard, Arthur A.
Lloyd, Alfred E.
Lovsey, William E.
Mann, William C.
Manwaring, Percy
Marsh, Lester C.
Mather, John J.
M'Carthy, Patrick F.
M'Kail, Samuel
M'Lauchlan, William
M'Vean, Hugh
Merwood, Frederick G.
Mewett, Frederic W.
Millington, Hugh E. G.
Muddiman, Ernest W.
Murgatroyd, James
Myers, Richard H.
Naish, John T.
Nason, Albert M.
Newby, Edgar J. E.
Norman, Colin
Nunn, Philip R.
Oliver, George
Onion, Robert E.
Overall, George W.
Owen, Thomas L.
Parker, William J.
Parry, George J.
Part, Harold G.
Pay, Henry
Pegg, Joseph
Pennington, Jesse F.
Penny, Charles
Perkins, Harold O.
Pickles, Harold
Pilditch, Cleverton L.
Pile, Frederick J.
Pilling, John R.
Poulson, Joseph
Powell, William A.
Pratt, James
Preston, John F.
Price, Conrad T.
Purse, Sydney J.
Rearden, Patrick J.
Ridsdale, George H.
Rippinale, Leonard W.
Roberts, Albert
Roberts, Frank
Roberts, John L.
Roberts, Walter S.
Rollins, Harold V.
Rooke, Edward
Roos, Alfred
Rose, George A.
Roust, William A.
Saunders, Arthur W.
Scanes, Leonard D.
Scott, Charles H.
Scott, Harold V.
Selden, Stephen T.
Shackell, Frank C.
Shaw, James S.
Shore, Charles L.
Short, Nicholas M.
Simmonds, Robert
Smith, Harold
Smith, Sydney G.
Spillman, Frederick W.
Stapp, George A.
Stock, Arthur R.
Stockwell, Henry
Stokes, John A.
Stone, John
Stooke, Sidney R.
Sutton, John E.
Sutton, Wilfrid L.
Sword, Herbert
Talling, Sidney H.
Tansley, William H.
Taylor, Gilbert A.
Taylor, Victor C.
Taylor, Walter
Teague, Harry E.
Telling, Thomas J.
Terry, John M.
Thomas, Leonard H.
Thornton, George A.
Thursfield, Samuel
Tidmus, Edward
Tilston, Joseph H.
Tomlinson, James D.
Tomlinson, Martin
Townsend, Reginald
Vail, John B.
Victory, Henry J.
Wallis, Frank V.
Walsham, John W.
Walton, John
Warren, Ralph M.
Weldon, Arthur E.
Welstead, Sidney H.
Wenham, Robert F.
Westington, Abraham
White, George
White, Walter F.
Whitworth, John W.
Williams, Stanley C.
Wilson, Alfred C. W.
Witham, Frank M.
Wright, Charles T.
Wright, Percy
Yates, Jack
Young, Donald

GRADE I.

Second Class.

Addison, Arthur J.
Ashley, James H.
Austin, William
Bagnall, Joseph J.
Bailey, William H.
Banford, Frank E.
Barrett, James V.
Bartlett, Thomas
Bell, John W.
Beveridge, Frank
Bew, Christopher
Blethyn, Albert E.
Bouch, Walter
Brandon, Ralph H.
Brutnell, Leonard
Buckley, Edward
Buckley, Frank R.
Burroughs, George
Cadney, Percy T.
Charge, Frederick
Charles, Francis E. B.
Chesterman, Harry W.
Coker, Cecil J.
Collins, Edwin
Connor, John
Constable, George A.
Cook, Geoffrey N.
Coombe, Percy F.
Corke, Frederick W.
Davies, Arthur H.
Davies, Peter
Dawes, Edwin
Dawson, Leonard W.
Delbridge, Frederick J.
Dipstale, Sidney E.
Drinkwater, Herbert G.
Eabry, Richard G.
East, George W.
English, George H.
Evans, James G.
Feltwell, Frederick H.
Field, Wallace J.
Ford, Albert
Ford, Francis V.
Ford, Frederick R.
Garrett, Jesse W.
Gay, Edward H.
Glass, Henry F.
Gosling, Gerald
Gowan, Albert A.
Greenhalf, John W.
Grosse, William
Grover, Hubert W.
Harris, William J.
Harvey, Frank J.
Hayward, Walter G.
Heap, William
Heath, John
Helyar, Ernest
Hennessey, William G.
Henton, Albert E.
Hobbs, Henry E.
Hodson, Arthur T.
Holben, Arthur R.
Holden, Leo P.
Hood, George
Humphries, William H.
Jones, Thomas
Jones, William J.
Josey, Arthur
Kenshole, William T.
Lally, Thomas E. J.
Lawton, Henry R.
Lenney, Arthur
Lewis, Richard S. B.
Marson, Joseph H.
Millard, Frederick H.
Millington, Sherlock
Moden, Robert
Moody, Bernard S.
Moseley, William
Murray, Stephen
Naish, William H.
Nuttall, Harry
Parsons, George H.
Pearce, Charles H.
Phelps, Leslie J.
Pitt, Ernest E.
Pocock, William
Pounder, Albert
Pritchard, Robert
Pritchard, William T.
Roe, Frederick H.
Samphier, George E.
Schofield, Charles V.
Shadbolt, Ernest
Smith, George F.
Squire, William E.
Steer, John F.
Stephens, James
Sumner, William
Taylor, William J. F.
Tilley, William T.
Tomlinson, Booth
Toms, Alfred T.
Tripp, Alfred J.
Tutton, Arthur
Viereant, Henry
Ward, Albert
Waters, Thomas W.
Watts, Albert C.
Webster, Harold B.
Wells, William E.
West, Arthur G.
Westwick, Frank W.
White, Albert H.
Williams, Arthur
Willmot, Geoffrey A.
Wingrave, Thomas A.
Woodley, Charles A.
Woodroffe, George F.
Woodward, Victor
Woolley, Philip H.

THE APPLICATION OF LOW-TEMPERATURE CARBONIZATION TO GAS-WORKS.

By G. E. Foxwell.

For some time past low-temperature carbonization has been greatly in evidence, and although at first looked upon with misgivings, it cannot now be doubted that in some form or other it has come to stay. During the last ten years or so, thousands of pounds have been spent on experiments, and after many discouragements and failures, investigators have now brought their ideas into workable form, and plants are actually working or in course of erection in this country. It has been frequently stated that the future of low-temperature carbonization lies with gas-works; it has also been urged that to be fully successful low-temperature systems must be worked with a view to supplying coal gas for industrial and domestic uses. In the present article the writer proposes to discuss this question of the application of low-temperature carbonization to gas-works.

In the first place, it is clear that no gas engineer will give up the present system of carbonization, with its attendant high yield of gas, in favour of a system which will only produce 5000 to 6000 cubic feet per ton of coal. In the writer's opinion, the only possible solution of the question is a combination of low-temperature carbonization and water-gas plant in which part of the residue left from the distillation would be completely gasified. This is, of course, a proposal of a similar nature to the "double gas" of Professor Strache. But it gives the added advantage of a gas conforming to the present candle power and calorific value standards without the necessity for carburetting, except under rare and unusual circumstances. The retorts would be heated by producer gas made in outside producers working on low-grade fuel, or a portion of the unpurified water gas might be used.

Objects of Low-Temperature Carbonization.

As at present worked, low-temperature carbonization systems are all designed with a view to producing a free-burning, smokeless coke, and a high yield of oils. Gas-works coke usually contains anything up to 2 per cent. of volatile matter, and only burns freely with a strong draught. For this reason it does not find great favour for household uses, and the gas manager often has considerable difficulty in disposing of his stocks of coke. It is found that if 5 or 6 per cent. of volatile matter is retained in the coke, it will burn freely and without smoke. This has the double effect of producing a cheerful fire and keeping the atmosphere clear. Low-temperature carbonization systems aim at retaining from about 5 to 10 per cent. of volatile matter in the coke. A high yield of oils is obtained, partly from the tar which is condensed and extracted by some form of tar-extractor, and partly by stripping the gas—a process that is analogous to the removal of benzol from coke-oven gas.

In some systems the distillation is carried out under a heavy vacuum, which may be anything from 15 to 28 inches of mercury in others, the retorts are worked under pressure, or gas is passed through the carbonizing mass to sweep away the products of distillation. The temperature varies with the different systems, usually ranging between 450° to 650°C. At the lower temperature the tar produced is of a wholly paraffinoid character, and strongly resembles petroleum in many respects. As the temperature rises towards 600°C. benzene bodies make their appearance, and an intermediate tar is produced. The amount of sulphate of ammonia produced is much the same as the ordinary gas-works yield, ranging between 20 and 28 lbs. per ton of coal carbonized.

Plant and Method of Working.

The retorts used are either inclined or vertical. In one system, the retorts, which are of iron, are placed at an angle of 15°; the coal being conveyed from a hopper at the lower end and through the retort by means of screw conveyors. The retorts are heated by a portion of the gas evolved, which is distributed by means of perforated iron pipes situated under the retorts. The length of time the coal is in the retort is regulated by the speed of the screw conveyor.

One of the principal points to be borne in mind in connection with low-temperature carbonization is that the layer of coal should be as thin as possible. In the design of the retort used in one of the best known systems, this has been specially allowed for. The retort is vertical, and consists of two concentric annular rings, each 2½ to 3 inches in diameter, and a small central ring. Coal is placed in the two outer rings, while a portion of the hot gases of distillation passes up the centre ring and helps to heat the interior. The retorts are heated from the outside, and are worked under a vacuum of 26 inches of mercury.

On leaving the retorts the gases evolved go to the bye-product plant. The heavy hydrocarbon vapours are first removed by a "P and A" tar-extractor. At this point the calorific value of the gas is about 1000 B.Th.U. per cubic foot. After passing the exhauster, the gas is subjected to a pressure of from 50 to 60 lbs. per square inch. This pressure is suddenly released, which has the effect of causing a quantity of light oils to condense, and to lower the calorific value of the gas to 750 B.Th.U. The remaining light oils and ammonia are then removed by scrubbing in the usual way; and the gas, the heating value of which has now been reduced to 300 B.Th.U. per cubic foot, is returned to heat the retorts. The gas obtained in this way amounts to about 5000 to 7000 cubic feet per ton of coal carbonized.

It will be observed that low-temperature systems as at present worked aim at producing smokeless fuel and oils; the gas being regarded as of comparatively little value except in so far as it serves to heat the retorts. Referring to the bye-product system mentioned above, it will be noticed that after the extraction of the tar there is left between 5000 and 7000 cubic feet of gas, having a calorific value of 1000 B.Th.U. per cubic foot—the amount of gas varying with the quality of the coal carbonized. In adapting such a system to meet gas-works requirements, it would seem advisable to stop at this point and use the gas for enriching purposes. The hot residue from the retorts might perhaps be

transferred directly into a water-gas plant, and gasified as mentioned previously, or the generator could be fed with cooled coke in the usual way if this was found impracticable. The water gas obtained would have a calorific value of about 320 B.Th.U. per cubic foot.

Low-temperature coke has proved suitable for use in water-gas plants. Owing to its low specific gravity it is found that the force of the blast has to be reduced; but its inflammability more than counteracts this. The rich gas from the low-temperature retorts would then be mixed with the blue water gas obtained, and would considerably raise its heating power. It must here be stated that since the candle power standard is rapidly being superseded by one based on calorific values, which will undoubtedly be the standard of the future, all the figures given, and estimates made, in this article are based on heating values only, though probably the same considerations would apply in the case of illuminating power.

The general effect of such a scheme may be seen clearly by considering the number of thermal units contained in the gas from a ton of coal.

	Total B.Th.U. Obtained.
Gas evolved from the low-temperature distillation of the coal = 5000 cubic feet, having a calorific value of 1000 B.Th.U. per cubic foot	5,000,000
Gas obtained by gasifying the low-temperature coke in a water-gas plant (= 70,000 cubic feet per ton of fuel) assuming that 14 cwt. of coke per ton of coal carbonized is being gasified in this plant = 49,000 cubic feet. The calorific value = 320 B.Th.U. per cubic foot . . .	15,680,000
Total, 54,000 cubic feet of gas . . .	20,680,000

That is to say, the gas obtained would have a calorific value of about 383 B.Th.U. per cubic foot.

Solid Smokeless Fuel.

In few places would the statutory standard be as low as 383 B.Th.U. It must be remembered, however, that gas companies do not exist solely for the production of gas; they have also another duty to fulfil to the public—namely, that of producing coke. It would be necessary, therefore, to instal a further low-temperature plant for the purpose of producing a solid smokeless fuel. The market for this would, of course, have to be cultivated for a time, until the properties of the new fuel were more widely known among householders. But the point to be borne in mind is that no excess of coke need be produced—in other words, the coke output may be varied with the demand. In these days of congested coke-yards, this seems a point worthy of serious consideration. If, however, at any period of the year the demand for smokeless fuel should become so low that the amount of coal carbonized to meet the reduced demand is not enough to produce sufficient enriching gas, carburetting could be resorted to, to keep up the gas to standard. In view, however, of the excellence of the coke produced, and the relatively small amount it would be necessary to make to keep the gas up to standard, this should never be required.

The gas evolved from these second retorts would serve to enrich the poorer gas obtained as above. Assuming a yield of 60 per cent. of coke and 12,000 cubic feet of gas per ton of coal in ordinary gas-works practice, it follows that for every 1000 cubic feet of gas made, 1 cwt. of coke is produced. This quantity of coke is rather more than the gas manager is able to sell comfortably. Supposing ¾ cwt. of coke were to be made by the low-temperature process for every 1000 cubic feet of gas produced, we get the following figures:—

	Equivalent to B.Th.U.
Total gas produced from 1 ton of coal (as given above) = 54,000 cubic feet	20,680,000
1 ton of coal produces about 14 cwt. smokeless fuel, allowing 0·75 cwt. of coke to each 1000 cubic feet of total gas output, 3·83 tons of coal would be required. Gas produced from low temperature distillation of 3·83 tons of coal = (approximately) 19,150 cubic feet of gas of 1000 B.Th.U.	19,150,000
Total, 73,150 cubic feet of gas . . .	39,830,000

This is equivalent to gas having a calorific value of 544·5 B.Th.U. per cubic foot. It gives a gas of quite a good quality; and by increasing or decreasing the amount of rich gas mixed with the water gas the heating value of the gas can be varied at will.

Financial Aspects.

An examination of the financial aspects of the scheme may not be out of place at this point. At the outset serious difficulties are encountered, in that no reliable information is available as to the actual yields of oil, &c., obtained under ordinary working conditions. Most of the figures issued to the general public have been obtained under test conditions, and would not be touched in general practice.

In order to arrive at a reasonable estimate of the finances involved by the scheme under consideration, a set of figures issued by a prominent low-temperature firm have been taken and 25 per cent deducted from all yields save coke and ammonia—this being taken as representing the difference between test conditions and ordinary working.

The total yield of oil from bituminous coal ranges between 16 and 22 gallons per ton. Taking the lower figure of 16 gallons, the yields obtained on fractionation would be about as follows:

Light oils	1 gallon
Middle oils	4·3 gallons
Lubricating oil	3 gallons
Pitch	70 lbs.

The other products obtained from the distillation of a ton of coal are:

Coke	14 cwt. (70 per cent.)
Sulphate of ammonia	24 lbs.

In the case of a works making 3 million cubic feet of gas a day, and with a gas yield of 12,000 cubic feet per ton of coal carbonized, the amount of coal used per day would be 250 tons. For every ton of coal used for gas making we have assumed that 3·83 tons would be used for coke making and the production of enriching gas, and so, since 4·83 tons produce 73,150 cubic feet of gas (as calculated above), the total amount of coal used to produce 3,000,000 cubic feet would be, roughly, 200 tons.

The account for each day's working, excluding purification and distribution costs, would be:

Receipts.

	£	s.	d.
Gas—3,000,000 cubic feet, at 1s. 6d. per 1000 . .	225	0	0
Coke—110 tons, at 15s. per ton	82	10	0
Sulphate of ammonia—2·14 tons—net value . .	9	18	0
Light oils—200 gallons, at 1s. per gallon	10	0	3
Middle oils—860 gallons, at 7d. per gallon . . .	25	11	8
Lubricating oils—600 gallons, at 6d. per gallon . .	15	0	0
Pitch—6·25 tons, at 35s. per ton	10	18	9
	£378	18	8

Expenses.

	£	s.	d.
Coal—200 tons, at 13s. per ton	130	0	0
Cost of heating and working retorts, at 2s. 6d. per ton of coal carbonized	25	0	0
Cost of distilling oils, at 2s. 6d. per ton of coal carbonized	25	0	0
	£180	0	0

From the above table it will be seen that about £200 per day would be available for expenses on the water-gas plant, purification from H_2S, distribution costs, and profit. It will also be noticed that the smokeless fuel produced is put at 15s. per ton; whereas in the balance-sheets of most low-temperature companies it is put at 30s. per ton. As previously mentioned, all the yields are some 25 per cent. lower than those usually given. There seems, therefore, no reason to doubt the *bona fides* of the above balance-sheet, since any error in the figures is on the side unfavourable to the proposed system. It must be noted, however, that if low-temperature systems were to be extensively adopted the prices obtainable for the bye-products would probably drop. The figures given for the cost of working the retorts and distilling the oils obtained are supplied by one of the best known low-temperature firms. It will also be noticed that the gas is put at quite a low figure.

Apart from the advantages enumerated above, the system would give freedom from naphthalene troubles, as, owing to the fact that the coal is distilled at a low temperature, no naphthalene would be formed.

Further Information Required.

There are, however, several points on which some further light is required before such a system can be seriously considered. In the first place so far as the writer is aware, little or no information is available as to the first cost of a low-temperature installation. According to Professor Lewes and other authorities, low-temperature carbonization is the most scientific method yet indicated of dealing with our coal supplies. It is unfortunate, however, in having come under the notice of the company promoter in some instances. As a consequence, schemes involving its use are looked on with suspicion alike by technical men and the general public. Another highly important point on which no reliable information is available is the cost of up-keep of a plant and the number of men required to work it. It is a well-known fact that a water-gas plant gives a great saving in labour over the usual retort-house practice; but whether a combination of low-temperature retorts and water-gas plant would do so seems open to question. In most low-temperature processes the time required for carbonization is somewhat prolonged when considered in conjunction with the weight of the charge, and this would militate against the adoption of these systems. But here, again, information is very meagre; and until it is forthcoming on the points enumerated, the gas engineer will not be anxious to alter his present system of carbonization.

Mr. Thomas Newbigging, D.Sc., M.Inst.C.E., whose death was recorded in the "Journal" for the 2nd ult., left estate of the gross value of £28,903, with net personalty amounting to £28,800. He has left a sum of £100 for distribution among the staff at his offices in Manchester and the servants at "Woodgarth," his residence at Knutsford. The residue is left in trust for the children equally.

CHARACTERS OF MECHANICALLY-FILTERED WATER.

By Professor SHERIDAN DELÉPINE, M.Sc., Manchester University.

[A Paper read before the Institution of Water Engineers.]

The effects of the treatment of water by means of coagulants and pressure mechanical filters do not appear to have been fully understood in the past. Since 1901, when the author for the first time observed on a large scale the action of pressure filters, he has had several opportunities of testing the action of important installations, and has more than once noticed that, though the results obtained were highly satisfactory, the conditions of guarantee suggested by, or imposed upon, the contractors had not been fulfilled, because the effects of filtration had been different from what had been expected. From a hygienic point of view, many of the requirements were valueless; and a consideration of what could be expected to take place in a mechanical filter would have been sufficient to show that some of the conditions could not be realized, and that among those capable of realization there were several which were not of material importance.

To make this clear, the author will briefly discuss the conditions of guarantee, included in a contract which came under his notice about four years ago. The water to be treated was a very soft one. The only conditions to which reference need at present be made were included in twelve clauses, which, in the form finally agreed to by both sides, read as follows:—

The contractors to guarantee purification to the following extent:

CONDITIONS OF PURITY OF WATER.

(1) The removal of 95 per cent. of the discoloration present in the raw water.
(2) The removal of 95 per cent. of the suspended matter and 45 per cent. of the organic matter in solution in the raw water.
(3) The filtered water not to take up more than 0·035 grain of lead in solution per gallon (0·05 per 100,000) after being in contact continuously with new lead during a period of 24 hours.
(4) The filtered water to have no odour when heated to 100° Fahr.
(5) The filtered water in appearance on examination in a 2-feet tube to be clear and bright.
(6) The filtered water not to contain any alumina in excess of that present in the raw water previous to treatment and filtration.
(7) The filtered water not to contain (*a*) any *coli communis* in quantities not exceeding 10 c.c. of water; (*b*) more than 100 bacteria growing at 20° C. on peptone gelatine (*plus* 10) in three days in 1 c.c. of water.
(8) The free ammonia present in the raw water to be reduced by at least 25 per cent. after treatment and filtration.
(9) The albuminoid ammonia in the filtered water not to exceed 0·003 grain per gallon (0·0042 per 100,000).
(10) The oxygen absorbed from permanganate in four hours not to exceed 0·035 grain per gallon (0·05 per 100,000).
(11) The permanent hardness of the filtered water to be increased not less than 10 per cent. above the raw water.
(12) The filtered water to have no deleterious action whatever on wrought-iron, steel, or cast-iron pipes.

In another contract which came under the author's notice at about the same time, some of the conditions were stated differently. Only five of these need be mentioned, viz.:—

(1) The colour of the filtered water shall not exceed 10 degrees of the platinum cobalt scale, when one degree corresponds to one part of platinum per million.
(3) The filtered water shall be tested for its action on lead in the following manner: A length of new lead pipe ½ inch internal diameter and 3 feet long, bent into the form of a U-tube, shall be filled with water from the sample to be tested. The ends of the tube shall be sealed, and the whole left standing for 24 hours. At the end of this period the tube shall be emptied, rinsed with the filtered water, and then refilled from the sample. The whole shall be sealed and again left for 24 hours, and the water then be run off and tested for dissolved lead. The lead found in solution shall not exceed 0·05 part per 100,000.
(5) The filtered water shall be free from turbidity, as measured by the immersion of a platinum wire 1 mm. in diameter, which shall be visible at a depth of 50 inches.
(7) *Bacteria.*—When the unfiltered water contains less than 500 per c.c., the bacteria present in the filtered water shall not exceed 20. When the unfiltered water contains more than 500 and less than 1000 per c.c., the bacteria removed shall, on the average, not be less than 97 per cent. of the whole, within a minimum for each sample of 96 per cent. When the unfiltered water contains more than 1000 per c.c., the bacteria removed shall not be less than 98 per cent.

Acidity.—The filtered water shall in no case be acid, and the alkalinity shall not exceed 1½ degrees. The test for acidity shall be made by evaporating 500 c.c. to a small bulk, and filtrating with N/10 caustic soda solution. The test for alkalinity shall be made by adding an excess of N/10 sulphuric acid solution, boiling to expel the carbon dioxide, and determining the excess of acid. The indicator used shall be phenolpthalein, and each degree of acidity or alkalinity respectively shall be equal to 1 c.c. of the corresponding N/10 solution used to neutralize 500 c.c. of the water.

The conditions enumerated above indicate fairly completely the characteristics which successfully treated water is expected to have. It will be noticed that some of these are indicated in absolute terms, while others are stated in terms relative to the characteristics of the raw water. The object in view in imposing conditions on a contractor is that the water should, after treatment, be free from any objectionable property—that is, so far as its essential properties are concerned.

A properly treated water intended for ordinary drinking and domestic purposes should be free from: (1) Discoloration. (2) Appreciable turbidity. (3) Any product capable of imparting to it an unpleasant taste or smell. (4) Any excess of bacteria, and more specially of bacteria indicating dangerous, or possibly dangerous, pollution. (5) Any material power to act on metals, and more specially on lead. (6) Any product imparting to the water an unusual physiological action. (7) An excess of mineral matter capable of imparting to the water excessive hardness.

It is quite possible to state in absolute terms the characteristics of a water satisfying these desiderata; and there are methods by which one can accurately ascertain whether a treated water meets these requirements. It is therefore unnecessary to rely upon the percentage improvement which has taken place as a result of treatment—a test which may lead to gross errors, seeing that the fulfilment of such conditions would not be proof that the water was fit for domestic purposes, and *vice versâ*. For example, a water so polluted that it contained before treatment 10 million bacteria and associated products of decomposition, would not be rendered satisfactory by treatment, even if the number of bacteria removed amounted to 98 per cent., for this would still leave 200,000 bacteria in the treated water. And, similarly, a reduction in the free ammonia by at least 25 per cent. would not in such a case be proof that other soluble objectionable products of decomposition were not present in the water.

On the other hand, no constant material reduction in the number of bacteria could be expected from the treatment of a water usually containing less than 10 bacteria per cubic centimetre; and a 50 per cent. increase in number would not be an indication that the water was unsuitable for domestic purposes. Neither is the absence of any reduction in the amount of free ammonia material when the quantity is originally very low. As a matter of fact, the quantities of free or saline ammonia usually present in drinking water are quite immaterial from a hygienic point of view, even when the water is distinctly polluted. The ammonia figure is only of use as an indicator of pollution when other more direct methods are not available for the purpose of ascertaining whether pathogenic or fæcal bacteria are possibly present.

The author now proposes to discuss some actual results obtained in connection with two installations of pressure mechanical filters of different types (erected by two of the leading firms in this country) which may be designated by the letters A and B. Both installations yielded excellent results; and for the purpose of this discussion we will suppose that the conditions enumerated at the beginning of the paper had to be met in each case. In both cases the waters to be treated were derived from peaty moorlands, were therefore liable to discoloration, soft, had a marked action on lead, and required the same kind of chemical and mechanical treatment.

Filter A had to deal with the water of four reservoirs. The water from each of them was examined both bacteriologically and chemically before and after treatment at short intervals during a period of over 1½ years; but it will suffice to deal with only one set of observations in each case. Some of the observations relate, in the case of A, to the initial period when the working of the filters had not been fully adjusted.

THE CONDITIONS DISCUSSED.

The author will deal *seriatim* with the conditions of guarantee in the light of the analytical results obtained in the laboratory.

CONDITION 1.—*Removal of 95 per cent. of the discoloration present in the raw water.*

The water of the four reservoirs was examined 32 times, and found, when examined in good daylight, in a 2-feet tube, to be—

	Before Treatment.		After Treatment.
Dark or dull brown	14 times	..	0 times
Brown	5 ,,	..	0 ,,
Yellow or brownish yellow	8 ,,	..	0 ,,
Yellowish green	5 ,,	..	0 ,,
Greenish blue	0 ,,	..	12 ,,
Pale blue	0 ,,	..	20 ,,

On attempting to estimate colorimetrically the amount of yellow or brown discoloration which had been removed by treatment, it was found that more than 95 per cent. of the discoloration had been removed in the 12 cases in which the colour of the treated water was greenish blue. It is obvious that when the water appeared to be of a pure blue colour, no trace of original discoloration could be detected.

In the case of installation B, the water of a reservoir was examined six times, and found to be:

	Before Treatment.		After Treatment.
Dull brown	4 times	..	0 times
Yellowish brown or dull brown	2 ,,	..	0 ,,
Greenish blue	0 ,,	..	4 ,,
Pale blue	0 ,,	..	2 ,,

These remarks indicate that, so far as the colour is concerned, the treatment can be considered as satisfactory when the colour of the treated water is either pale blue or greenish blue; and a statement to this effect is far more likely to be correct and to be clearly understood than a figure indicating the percentage of dis-

coloration removed, as may be done by the platinum or other colorimetric method.

CONDITION 2.—*Removal of 95 per cent. of the suspended matter and 45 per cent. of the organic matter in solution in the raw water.*

The second part of this clause is, in the author's opinion, entirely unnecessary. The figures relating to oxygen absorbed, and various nitrogenous products would, if information were needed regarding organic products, give most of the particulars required. The estimation of volatile and organic matter as usually conducted does not furnish results capable of simple interpretation.

The first part of the clause which relates to suspended matter is one which offers certain difficulties of interpretation. The coarse suspended matter which was present in most of the samples of raw water was invariably removed by treatment, and in ordinary light the treated water appeared to be quite clear. A platinum wire, 1 mm. thick, could invariably be seen through 50 inches of water; but when the treated water was strongly illuminated, and examined against a dark ground, a slight turbidity or opalescence was usually recognizable. This turbidity was not due to the suspended matter originally present in the raw water, but to the presence of extremely fine particles. This slight turbidity was generally more marked when the quantities of chemicals had not been completely adjusted. Before this was done, it was possible by gravimetric method to show that there was slightly more insoluble suspended matter in the treated than in the untreated water. After adjustment the reverse was true; but in both cases it was clear that the suspended matter which caused turbidity in the raw water had been replaced in the treated water by another kind of suspended matter. This suspended matter was composed almost entirely of minute particles, many of which were almost ultramicroscopic. It had, therefore, nothing in common with the coarse particles which caused the turbidity of the untreated water.

When the treated water was made to pass through a sedimentation tank, a dark gelatinous layer was, in the course of several months, deposited on the sides and the bottom of the tank. This deposit was due to the separation of the fine particles contained in the water. Through Mr. Molyneux's kindness, the author has had an opportunity of investigating the nature of this deposit. By a process of elutriation it was possible to separate from it five types of constituents:

(1) Fine heavy reddish, greyish, and white sandy particles, which separated easily from water in about a minute (that is, after they had been freed from the surrounding gelatinous mass). These particles had to the naked eye the characters of fine sand grains and siliceous *débris*. This part of the sediment was very scanty.

(2) Much finer heavy particles of a dark grey colour, which separated from the water almost as rapidly as the coarser particles.

(3) Extremely fine dark brown particles held by semi-gelatinous flakes, which separated from the water in about half-an-hour in the form of a semi-gelatinous mass. This contracted in the course of 24 hours to about one-half of its original bulk.

(4) A greyish-white sediment difficult to separate from the previous parts, and composed of very light flakes. In the course of several hours these formed a very light flocculent sediment, which continued to contract for several days.

(5) After separation of these various deposits, the water still retained a slight whitish opalescent appearance, due to the presence of extremely minute particles, which in the course of a month formed an extremely thin whitish film on the bottom of the vessel to which it adhered. This layer could be separated from the vessel as a very soft whitish pellicle.

At the author's request, Mr. Heap (who is in his laboratory) kindly analyzed these various constituents, with the results given in the following table:

—		General Composition of Deposit.				Mineral Matter.				
No.	Weight Moist.	Water.	Organic Matter.	Mineral Matter.	Total Solids.	Iron. (Fe_2O_3.)	Alumina. (Al_2O_3.)	Silica. (SiO_2.)	Calcium. (CaO.)	Magnesium. ($Mg_2P_2O_7$.)
1.—Heavy coarser particles, sand like. .	5·263	3·654	0·249	1·360	1·609	0·198	0·075	0·923	0·139	0·032
2.—Heavy fine particles dark sand like .	3·462	3·124	0·091	0·247	0·338	0·045	0·036	0·090	0·023	0·049
3.—Dark brown gelatinous deposit. . .	92·625	85·978	1·804	4·843	6·647	1·405	0·2078	2·179	0·526	0·385
4.—Greyish white gelatinous deposit . .	26·134	25·816	0·094	0·224	0·318	0·026	0·055	0·071	0·044	0·013
5.—Water separated from sediment . .	530·000	529·899	0·039	0·062	0·101	0·001	0·002	0·004	0·023	0·010
Totals.	657·484	648·471	2·277	6·736	9·013	1·675	0·3758	3·267	0·755	0·489

The composition of this sediment indicates that it is partly composed of fine particles derived from: (1) The filtering material. (2) The walls and other parts of the filter which are composed of iron. (3) Precipitates resulting from the addition of lime salts, and from the rearrangement of the constituents of the water during treatment. It will be noticed that this alteration in the composition of the water is one of the desired effects of treatment, and that when a soft water is dealt with, it is reasonable to expect an increase in the amount of soluble mineral constituents.

The finer particles of iron and silica are probably produced by attrition during the washing of the filters when the grains of sand or broken quartz are thrown into a state of active motion.

The suspended matter just described may, by deposition in the mains, form very slowly a thin coating, which for a long time would be incapable of reducing materially the carrying capacity of the mains, and would probably have a protecting action. Such a coating should be easily removed by simple mechanical means if it ever became too thick.

Very different effects are observed when untreated moorland waters are conveyed by iron pipes. In such cases the inner surface of the pipes is rapidly incrusted with organic matter mixed with mineral deposits. This incrustation is associated with more or less rapid erosion, more especially when the deposit scales-off or is removed. The author has seen pipes lined in this way with rough nodulated deposits more than ½-inch thick, firmly adherent and very hard, which diminished considerably the carrying capacity of the mains.

The nature of the suspended matter which is found in treated water, is interesting chiefly from this point of view, for, as previously explained, this matter does not affect either the appearance or the hygienic value of the water.

CONDITION 3.—*The treated water not to take more than 0·035 grain of lead in solution per gallon (i.e., 0·05 part per 100,000).*

The results obtained at installations A and B showed that this important condition was easily met, even in the case of water having considerable action on lead before treatment.

The author has, in another place,* explained that, in order to obtain comparable results, it is necessary to use pure bright lead under very definite conditions for the purpose of testing the action of water on that metal. The method described in the second set of conditions enumerated at the beginning of this paper does not appear satisfactory, for the author has found that the action of the same water on several new lead pipes obtained from the same source varied considerably. Some pipes yield much more lead than others. Lead pipes which have been exposed to air containing traces of sulphuretted hydrogen yield much less lead, even after several washings, than pipes which have always been kept in air free from that gas. The action of water is modified by many other factors which cannot be controlled when lead pipes are used for the purpose of this test.

CONDITIONS 4 AND 5.—These need not be discussed. It is sufficient to say that the treated water was always found free from odour. The question of clearness has already been discussed under Condition 2.

CONDITION 6.—*The filtered water not to contain any alumina in excess of that in the raw water previous to treatment and filtration.*

The accurate estimation of the amount of alumina in the raw and in the treated water was found to involve an expenditure of time which the results did not justify. Both before and after treatment the amount found was very small, and, with very few exceptions, no excess of alumina was discovered in the treated water. The slight turbidity and the increase in the amount of solids previously alluded to cannot, therefore, be attributed to an increase of that product during the passage of the water through the filter.

The results of forty analyses made in the author's laboratory by Mr. Heap may be tabulated as follows:—

INSTALLATION A.—*Alumina in Water.*

Reservoir 1.		Reservoir 2.		Reservoir 3.		Reservoir 4.	
Before Treatment.	After Treatment.	Before Treatment.	After Treatment.	Before Treatment.	After Treatment.	Before Treatment.	After Treatment.
0·05	0·05	0·20	0·10	0·20	0·20	0·40	0·20
0·17	0·05	0·42	0·02	0·14	0·05	0·29	0·24
0·08	0·05	0 33	0·23	0·33	Traces	0·27	Traces
0·02	0·02	0·03	0·03	0·65	0·10	0·75	0·80
0·60	0·95	0·50	0·90	0·35	0·10	0·30	0·20

CONDITION 7.—*The filtered water not to contain (a) any B. Coli Communis in quantities not exceeding 10 c.c. of water; (b) more than 100 bacteria growing at 20° C. on peptone gelatine in three days in 1 c.c. of water.*

With regard to installation A, quantities of raw water exceeding 10 c.c. were tested 62 times, and the *B. Coli Communis* was found to be present on seven different occasions. The treated water

* "Journal of the Royal Sanitary Institute," Vol. XXXV., p. 117.

was tested the same number of times, and never found to contain this bacillus in 10 c.c. Over 100 c.c. of each sample was used in each test. Installation B yielded equally good results.

With regard to the total number of bacteria, in the case of installation A, the number found in the treated water rose above 10 on seven occasions out of 32, and above 20 only once out of the same number of observations, when the total reached 47. The results were, therefore, eminently satisfactory. Yet on four occasions on which there were only 1, 2, and 5 bacteria in the untreated water, there was an increase after treatment; but it was quite immaterial. If the condition as regards the number of bacteria had been stated in the form of a percentage improvement, as in the second set of Conditions No. 7, the treated water would have been condemned on these four occasions; and yet on each of them the treated water would have been of great bacterial purity. The number of bacteria in the raw water before treatment was generally low, but it reached 1400 once, 385 once, and was about 50 or more on nine occasions. Installation B also yielded excellent results as regards the reduction in the number of bacteria.

CONDITION 8.—*The free ammonia present in the raw water to be reduced by at least 25 per cent. after treatment and filtration.*

The author has already stated that this condition is of no importance and should never be insisted upon. As a matter of fact, it does not appear to be capable of realization. In the case of installation A, the results obtained in connection with each of the four reservoirs were as follows:—

Free Ammonia in Treated Water as Compared with Raw Water.

—	Increased.	Unchanged.	Reduced.
Reservoir 1	1 occasion	2 occasions	5 occasions
,, 2	1 ,,	5 ,,	2 ,,
,, 3	2 occasions	1 occasion	5 ,,
,, 4	1 occasion	3 occasions	4 ,,
Totals . . .	5 occasions	11 occasions	16 occasions

With regard to installation B, the free ammonia was increased twice, unchanged once, and reduced once.

CONDITION 9.—*The albuminoid ammonia in the filtered water not to exceed* 0·003 *grain per gallon* (0·0042 *part per* 100,000).

Installation A gave very good results. The albuminoid ammonia was reduced, sometimes considerably, on 32 occasions out of 32. Once only was the reduction so slight as to be doubtful. The amount found in the treated water was well below the limit indicated, except on three occasions when the quantities found in the treated water were respectively 0·0048, 0·0044, 0·0044—*i.e.*, 0·0006, 0·0002, 0·0002 above the amount allowed, which are insignificant quantities well within the limits of experimental error. Installation B yielded similar results.

CONDITION 10.—*The oxygen absorbed from permanganate in four hours not to exceed* 0·035 *grain per gallon* (0·05 *part per* 100,000).

This condition was amply fulfilled by filters A and B on 34 out of 36 occasions, and the two failures were due to exceptional and accidental circumstances. The amount of oxygen absorbed by permanganate of potash indicates the amount of oxidizable matter which is chiefly organic matter. The removal of this is important, and this was very thoroughly effected by the filters.

CONDITION 11.—*The permanent hardness of the water to be increased not less than* 10 *per cent. above that of the raw water.*

When dealing with hard water, it might be convenient to indicate in terms of percentage how much the hardness should be reduced; but in the case of a soft water, when increase of the hardness has for object the removal of the action which the water has on lead, it is useless to demand a percentage increase. What is wanted is that the water should not act on lead; and this can be tested directly. It is also obvious that when a water is exceedingly soft, a 10 per cent. increase may be quite insufficient to render the water inactive as regards lead. This is actually what happened in one instance. The hardness had been increased by treatment to the extent of 30 per cent., and yet the water had still a marked action on lead.

The reaction of the water is a better indicator of its probable action on lead. But even the reaction cannot always be depended upon; and it appears to the author safer to rely on a direct estimation of the actual action of water upon pure lead than to trust to the indications given by hardness or reaction. The reaction is, however, a valuable indicator in the practical working of filters. When one knows the average composition of water and the extent of its action on lead, the reaction may be generally used with advantage for the purpose of determining the quantity of chemicals to be employed.

The tests for reaction given in the second set of conditions quoted at the beginning of the paper do not, however, seem to the author so suitable in current work as the combined use of three indicators. Mr. Heap has paid special attention to this point, and has supplied the following short statement of the way in which he estimates the reaction in ordinary routine work:

Indicators.

Methyl Orange.—2 grammes dissolved in 1 litre of water.

Lacmoid.—2 grammes dissolved in 1 litre of 75 per cent. alcohol and water.

Phenolphthalein.—2 grammes dissolved in 1 litre of 75 per cent. alcohol.

Titration.

In the case of waters showing an alkaline reaction with an indicator, they are titrated with centinormal sulphuric acid; and in the case of an acid reaction, the titration is made with centinormal caustic soda. The quantities taken are 100 c.c. of the water and 1 c.c. of the indicator.

The results are expressed in cubic centimetres of normal acid or alkali in 100,000 c.c. of the water.

Methyl Orange.—This gives the bicarbonates of calcium and magnesium.

Phenolphthalein Lacmoid.—When no colour is given in the cold with phenolphthalein and the water is alkaline to lacmoid, it means that no normal carbonates are present, and that the alkali in it is due entirely to acid carbonates.

GENERAL CONCLUSIONS.

The facts recorded in this communication show that the results of treatment by coagulants and mechanical filtration of soft moorland water are eminently satisfactory when reliable plants are used. The author has also had the opportunity of observing the effects of treatment of hard waters by the same method, and these have also been satisfactory. The seven essential conditions indicated at the beginning of the paper can easily be met when the best types of pressure mechanical filters are properly worked. As to the conditions to which the author attaches little or no importance, some have been satisfied, while others have remained unsatisfied. He would, therefore, suggest the following conditions as meeting the requirements of the case:—

Essential Conditions.

(1) The water viewed in a 2-feet tube shall be of a pale blue colour, or retain not more of any original yellow or brown discoloration than an amount capable of giving to the water a bluish green colour.
(2) The water viewed in a 2-feet tube shall be clear.
(3) The water when heated to 30° C. and to 100° C. shall be free from any appreciable smell.
(4) One c.c. of filtered water shall never contain more than 100 bacteria, capable of growing in three days on peptone bouillon gelatine (+ 10) incubated at 20° C.
(5) Any quantity less than 10 c.c. of the filtered water shall not contain the *B. Coli Communis*.
(6) The filtered water shall have no material action on bright pure lead after being in contact continuously for 24 hours at a temperature of 20° C. [By material action is meant an action causing the taking-up by the water of more than one part of lead in 2 million parts of water. When the lead is completely immersed, the ratio between the surface of lead and the volume of water is as 1 : 4.]
(7) The hardness of the filtered water as tested by Clark's method shall not, except in special cases, exceed 10 per 100,000.
(8) The amount of alumina in the filtered water shall not exceed the amount of alumina in the raw water.
(9) The filtered water shall contain no copper, lead, zinc, or more than traces of iron.

Conditions Regarding which the Scientific Referee may Exercise his Discretion.

(10) 100,000 parts of filtered water should not take more than 0·05 part of oxygen from permanganate of potash in acid solution in four hours at 27° C.
(11) Free ammonia in the filtered water should not exceed 0·02 part in 100,000.
(12) The albuminoid ammonia in the filtered water should not exceed 0·005 part per 100,000.

The author concluded by expressing his thanks to several persons for help in the preparation of his paper; among others to Dr. E. J. Sidebotham and Mr. H. Heap, who respectively have charge of the bacteriological and the chemical analysis of water in his laboratory.

[Appended to the paper were two tables giving the results of the analyses of two sets of samples of water.]

DISCUSSION.

Mr. F. J. DIXON said the paper was very interesting, especially as it covered two installations of different type treating similar kinds of water. He understood that Professor Delépine somewhat condemned the list of conditions of guarantee which were included in installation A. He (Mr. Dixon) happened to be the unfortunate gentleman who formulated these conditions; this was about four years ago. While he would admit that they were severe, he thought that, if anything, they erred on the right side from the engineer's point of view. His only regret in regard to them was that, when formulating his specifications and conditions of guarantee, he had not more knowledge in certain directions which would perhaps have justified him in excluding the conditions which Professor Delépine condemned as valueless. He regretted that he was not then able to call in the advice of eminent scientists, such as Professor Delépine or Professor Frankland; but he had done the best he could under the circumstances with a view to safeguarding his Committee. He felt, after the paper, that he had attained this object at any rate, and thought they would notice, from the concluding remarks of Professor Delépine, that

the results had come out fairly satisfactorily from the basis of the original points he had in mind. The conditions for installation B were, he believed, made out by Professor Frankland, and he (Mr. Dixon) noticed that in No. 7 the Professor drew their attention to the percentage of the reduction of the bacteria, and had not a very satisfactory opinion about it. He (Mr. Dixon) must admit that in his No. 7 he did not include the percentage, but stated definitely that there should not be a certain number of bacteria in so many cubic centimetres of water. He thought this had been fully justified by the results. The colour of the water, as stated by Professor Delépine, must be very satisfactory. He noticed that out of the 32 samples which he tested, it was practically colourless. Professor Delépine stated that 95 per cent. of the discoloration had been removed in the twelve cases in which the colour of the treated water was greenish blue, and that the remaining samples, after treatment, were all pale blue, and had all the characteristics of a pure water. He thought this showed that the results were very highly satisfactory owing to the mechanical filtration. The information as to suspended matter was very interesting indeed. In regard to the original samples which he sent to Professor Delépine somewhere about eighteen months or two years ago, when the Professor sent back the results of his examination he (Mr. Dixon) was greatly at a loss as to why there was an increase of suspended matter. He could not understand this; and he thought the contractors would not be able to comply with the conditions, but would want to know why it came about. He was very glad to find that the increase of suspended matter in the treated water was accounted for by the fine particles of the filtering medium, which was evidently passed through the filter and again into the water. At the commencement of the installation, in fairness to the contractors who put in this plant, he noted that there was a certain amount of dust, which might be anything from 5 to 10 per cent., and was due to the sand particles rubbing against each other in the constant washing and silting-up of the filter, especially in the installation which he had had under his own control. They were all familiar with the method of washing, and knew how this could occur. In the process of washing the filtering medium, he found that a small part of it was not thoroughly washed; and he drew the attention of the contractors to it, and suggested that he was of opinion that this was due to the very high velocity with which the water went through the central tube and came into contact with each particle of sand, the effect of which was that there was not sufficient time allowed to wash each particle of sand thoroughly, which might have been done by bringing it slowly through the tube and very carefully washing. At that time their speed of working the propellers was something like 650 revolutions per minute. This was a very high speed, and the life of the propellers and the jets would be very short, because of the attrition, though the propellers and the jets—made of hardened steel. He suggested to the contractors that they should reduce the speed; and they did so to something like 350 revolutions per minute, and with excellent results. The Professor, of course, was unacquainted with these conditions, and he could not understand until the change was explained why the suspended matter was not increased in the filter as it had been hitherto. But he (Mr. Dixon) told him the reason; and thereupon the Professor attributed it undoubtedly to the attrition of the filtering medium through running at this high speed. At the lower speed there was very little dust taken off the stone; and he found that the washing of the filters was greatly improved by the slow speed of the propellers. With regard to the sediment which the Professor found in the samples given to him by the President from the clear-water well at Kinder, he had never in his investigations noticed such a deposit, and he was wondering whether it was due to the velocity of the water passing through the pipes. In connection with this, it was interesting to note that there had been very little sedimentation in the installation to which he referred, especially since they had reduced the speed of the propellers. He was very much obliged to the Professor for giving them the constituent parts of this sediment. He thought they would all agree with him in praising the very excellent way in which the Professor arrived at the action of the water on lead. The test conducted by him for this action was undoubtedly the most severe one to which the water could be put; and if it came out satisfactorily, they might, he thought, be sure that it was a water in which there would be no plumbo-solvent action. The Professor had enumerated in his paper indicators which were very useful to the man in charge.

Mr. W. T. Burgess said he could fully support Professor Delépine in his suggestion of the unreasonableness of some of the conditions. The Professor's references to the action of water on lead were very useful indeed. He noticed that it was stated that under treatment the water should not be capable of acting on lead to a greater extent than 0·05 part per 100,000 gallons. He had heard the opinion expressed that even this proportion was undesirable; and he certainly thought the Professor had not erred on the side of unreasonableness in declaring that the water should not have greater action upon lead than that stated. He had tried all sorts of methods for testing water for its action on lead, and he still pinned his faith to trials of lead pipes themselves, and thought he should continue to do so.

The President (Mr. T. Molyneux) said that for lack of time he had to close the discussion, and would ask that any further questions should be put into writing and answered in writing for the "Transactions." With regard to Kinder, the analysis was a most interesting one, because it gave comparative analyses of the water as it left the filters, taken from a tap on the pipes, and from a tap in a house nine miles away from the filters, after the water had passed through the filtration tank at Kinder and a reservoir which held 4 million gallons. The results of the two analyses were almost identical. Mechanical filtration was a development of a process which was first used for clarifying water for manufacturing purposes, but which, by the help of gentlemen like Professor Delépine, had been so perfected that the water now turned out by such filtration was practically equal to distilled water. He moved a vote of thanks to Professor Delépine.

Professor Delépine, in acknowledging the resolution, said that as time was short he would reply by letter; but he wished at once to remove a misapprehension in Mr. Dixon's mind. He did not consider that Mr. Dixon was at all responsible for the conditions which he had criticized. He was only responsible for being too well informed of what was supposed to be necessary at that time by experts, more especially by chemical ones. Mr. Dixon found what the experts considered necessary, and put their views together, and so constructed conditions of which some, as he told him at the time, immediately he saw them, would never be fulfilled. He had not intended to criticize Mr. Dixon, and could only express his admiration for the industry with which he had collected them.

CARBONIC OXIDE AND NITRIC OXIDE FROM LIGHTING AND HEATING BURNERS.

The "Journal für Gasbeleuchtung" for the 27th of June and the 11th inst. contains a communication by Dr. E. Terres on researches which he has carried out, with collaborators, at the Chemical-Technical Institute of the Technical College at Carlsruhe. He has investigated the proportion of carbonic oxide and nitric oxide in the gas-flames of both lighting and heating burners, with the object of throwing further light on the hygiene of flame methods of lighting.

The products of combustion examined included those from both inverted and upright incandescent gas-burners, the petroleum lamp and the candle, and heating gas-burners. The work on the inverted burner is especially interesting, as it has not hitherto been investigated from this standpoint. The general conclusions at which the author arrives are:

1.—All flames give a very trifling proportion of carbonic oxide, of approximately the same order as to quantity in all cases—viz., 0·002 to 0·004 volume of carbonic oxide per volume of carbonic acid. With insufficiency of primary air, this figure may rise to 0·017 to 0·020 volume.
2.—All flames likewise give a quite uniform, but quite trifling, proportion of nitric oxide—viz., 0·0006 to 0·0017 volume of nitric oxide per volume of carbonic acid.
3.—The products of combustion with town gas containing the usual quantity of sulphur will have 0·00025 to 0·0012 volume of sulphur dioxide per volume of carbonic acid.

The concentration of all these gases, even if the carbonic acid reaches 1 per cent. by volume of the air, is, therefore, far below the limit which authorities on hygiene regard as likely to be injurious to health. Experiments in a room of 1700 cubic feet capacity without special ventilation showed that, owing to natural ventilation, a proportion of 0·5 to 0·75 per cent. of carbonic acid could only rarely be attained in a dwelling-room lighted by gas.

Presentation to the Lord Mayor of Leeds.

Mr. E. A. Brotherton, Lord Mayor of Leeds, and Chairman of Messrs. Brotherton and Co., Limited, entertained the whole of the firm's workpeople and their families, last Friday week, at a garden party in the grounds at his residence, The Hall, Roundhay; each employee receiving a medal specially struck to commemorate the event. The company, which numbered about 1200, came from the works of the firm in Leeds, Liverpool, Birmingham, Middlesbrough, Sunderland, Workington, Glasgow, Wakefield, and other places. A number of special trains were employed to bring them to Leeds; and they travelled by special cars to Roundhay. After lunch in a large marquee, Mr. Brotherton was the recipient of a handsome token of the sincere respect and esteem in which he is held by the employees, who presented him with a bronze bust of himself. Every one of the departments of the firm subscribed to the gift; the workmanship of which was carried out by Mr. E. Caldwell Spruce, the Leeds sculptor. It stands on a 4-feet pillar of Connemara marble. The presentation was made by Mr. John Wyld, one of the Directors of Brotherton and Co. He remarked that Mr. Brotherton had started business 36 years ago, a young man with a powerful business imagination and the pluck to undertake large contracts, though he did not consider any contract too small to be worth his attention. As a result, a business had been built up which was the largest of its kind in the world. In thanking the company, the Lord Mayor said that the most cordial relations had always existed between himself and his employees. He had always set before him the idea of treating his men with generosity and with absolute justice, and he felt proud to claim to-day that he had not failed in this intention.

GAS AND HYGIENE.

[Abstract Translation of the Lecture delivered to the German Association by Professor Dr. M. von Gruber, of Munich.]

A short notice of the lecture appeared in last week's "JOURNAL" [p. 26], and we are now able to give a translation of the official abstract issued by the German Association at the end of their recent meeting in Munich. We hope, however, to be able to amplify still further the record of Dr. von Gruber's interesting work, when the full report (with tables and diagrams) is available.

The circumstances in which the researches of Dr. von Gruber were made were explained last week in the "JOURNAL." He stated that, in order to obviate difficulties arising from weather and other external conditions affecting temperatures, ventilation, moisture, &c., which reduce to such an extent the value of work like this, the experiments on the effect of lighting by gas and electricity were for the most part carried out simultaneously in two rooms of equal size—57½ cubic metres [about 2030 cubic feet] —and of practically like fitting and disposition. The position of the laboratory between these two apartments enabled observations and readings to be made on both sides at the same time. All three rooms were situated, facing almost due east, in one corridor of the third (top) floor of a house, with unoccupied rooms on each side. Parquet floors rendered them practically independent of the storey below, as regards change of air. At first both rooms were papered; then one papered and the other whitewashed; and, finally, both were whitewashed. Each was provided with electric metallic filament lamps and inverted Graetzin gas-burners, consuming an average of 42 litres [1·48 cubic feet] per hour. They were so chosen that each kind of lamp in the same vertical plane at 3 ft. 6 in. gave 50 hefner candles [45·75 English candles].

The heating was done with gas-fires, which could be supplied with air either from within the room, or from the corridor outside; while the products of combustion passed off through a chimney. One room was provided with a ventilator in the window, and with a tube of 25 cm. diameter which could be closed at will, and which projected from the ceiling above the stove 50 cm. into the room. The ceiling and walls were pierced by numerous small tubes, by the help of which the distribution of pressure in various parts of the room could be measured. The gas-lamps were fitted with distance-lighting devices, so that they, like the electric lamps, could be singly lighted or extinguished from the laboratory. The mixing of the air in the rooms could, when desired, be effected by electric fans. As regards determination of the temperature, moisture, and carbon dioxide content of the air, and the withdrawal of air from them for breathing tests, all this was provided for by tubes passing through the doors which connected the rooms with the laboratory. These doors were also provided with windows which permitted observation of the rooms. All windows could be closed to exclude light. By a system of glass tubes air could be drawn off for the carbon dioxide determination at sixteen points at three different levels in each room. At the same sixteen points the temperature could be read from the laboratory by means of distance resistance thermometers. Meters for measuring the gas and electric current, &c., consumed in the rooms and a respiration apparatus completed the equipment of the laboratory. Thus there was no necessity to enter the rooms during the tests. They were assumed to be either the sitting-room of a family, gathered round one lamp in the evening, or else an office with two, or at the outside three, double desks, each supplied with one lamp. In order to avoid any suggestion that the best possible conditions had been taken, the experiments were carried out for the most part in the least favourable circumstances for ventilation and heating—*i.e.*, on warm days, with little wind, and with completely closed-up, unventilated rooms, and with lamps burning for six, seven, or even more hours, such as is only the case with poorer people in the depth of winter.

The most important conclusions may be summed-up by saying that quite a number of the reproaches commonly made against gas lighting of dwelling-rooms can be refuted, or at any rate considerably reduced in importance. Some of the facts determined may be mentioned in detail. Sulphurous acid could not be found in the air of the room even in minute traces. In agreement with the recent experiments of Dr. Terres in the Bunte Laboratory, no trace of carbon monoxide was ever found in the combustion products from incandescent gas-lamps, even with the most sensitive tests, and even after burning more than 10 cubic metres [35 cubic feet] of gas in six or seven hours. The experiments of Terres have shown that in the most exceptional and unfavourable circumstances (raising of the carbon dioxide content by four parts per thousand), the air of the room could not contain more than 0·0156 per cent. by volume of carbon monoxide. Nitric oxide was found in almost all cases in which it was tested for in the air of gas-lighted rooms. The maximum quantity found was 10·4 per cent. per cubic metre. According to Terres' finding, the air of the room could only contain in the most unfavourable circumstances 0·00066 per cent. of nitric oxide, which can be considered a negligible quantity. When the lamps burn continuously the carbon dioxide content and the temperature of the air do not increase without limit, but soon (within five or six hours) reach an almost constant maximum.

The mean carbon dioxide content of an unoccupied room in no case exceeded 1·5 parts per 1000 with one lamp burning. With two lamps burning it exceeded 3 parts per 1000 in only two out of a series of fourteen tests. With three lamps, 4 parts per 1000 was reached only once in thirteen cases, while in five cases the carbon dioxide content remained below 3 parts per 1000. When the carbon dioxide content of the air has reached about 2 parts per 1000 by volume, human breathing increases in depth. The number of respirations is very little influenced. This effect on the breathing is caused by the carbon dioxide, and is brought on alike by the air of a gas-lighted room and by air containing the products of breathing. The increase in the depth of breathing only becomes perceptible in changing from pure air to contaminated air when the carbon dioxide content reaches 10 parts per 1000. No effect of the contaminated air on the oxygen consumption and the carbon dioxide production of the human organism was noticeable until 17 parts per 1000 of carbon dioxide was reached. Air containing pure carbon dioxide apparently had no different effect to that containing products of breathing and gas combustion.

The mean temperature of the air of a room in which one to three Graetzin lamps had been burning four to nine hours reached 24° C. in only one case. Only in eight cases out of thirty-three was a temperature of 22° C. reached. The absolute height of the final temperature depended largely on the heating of the room. The increase in mean temperature over four to six hours of burning of one lamp was, under otherwise varying conditions, 2·05° C. (1·1° to 3·0°), with two lamps 1·48° C. (0·4° to 2·4°), and with three lamps 3·14° C. (1·3° to 4·4°). The mean temperatures at the level of the head represented fairly exactly the mean temperature of the whole room, but the mean temperature by the ceiling was considerably higher. The relative moisture at the end of the time averaged 42·2 per cent. with one lamp, and 54·7 per cent. with two lamps. The moisture of the air in a dwelling-room should be between 40 and 60 per cent.

The comparative tests between gas and electric lighting were made, as already stated, under the conditions the least favourable to the former—4 to 7 hours' burning of 2 or 3 Graetzin lamps, or 4 to 6 hours' continuous occupation of one room with one lamp by 5 or 6 persons. The greatest difference in temperature found was 1·6° C., and the greatest difference in moisture increase 10 per cent. In most cases the differences were less than 1° C. and 5 per cent. respectively. The ventilation of the unheated, unlighted, or electrically-lighted unoccupied rooms amounted on an average to not quite one-third of the volume of air in the room (18 cubic metres per hour), and with gas lighting two-thirds of the volume of air (38·4 cubic metres per hour). The ventilation of the unpapered room was found on an average to be 17 per cent. greater than that of the papered one. Opening and closing the door by half-hour intervals increased the ventilation by some 10 per cent. Keeping the doors of the gas-stove open increased it by some 20 per cent. Keeping open the stove doors and the windows caused the ventilation to be almost doubled. The heat produced by the gas-lamps did not increase the ventilation to such a degree as to improve the air of the occupied room.

NOTES FROM ABROAD.

American Street Lighting.

The Boston Consolidated Gas Company has recently obtained a ten-year contract for lighting the city by gas for $210,000 a year. The mayor, however, has the right to terminate the contract at the end of five years by giving notice between April 1 and July 1, 1918. The price of one lamp per year by this contract is $21 [87s. 6d.].

Gas Appliance Makers' Society in U.S.A.

At a meeting of appliance makers in New York on June 13, the foundations were laid of a Society on the lines of our "S.B.G.I." The objects of the new Society are the "advancement of the interests of its members and co-operation with such other Associations as shall accomplish this object." It is to be governed by a board consisting of a president, three vice-presidents, a secretary, and a treasurer. Temporary officers having been elected, it was decided that they should call a meeting at a later date to complete the organization and transact other business.

Stockholm Gas-Works in 1913.

The gas production of the Stockholm Gas-Works in 1913 was 44,720,880 cubic metres [about 1580 million cubic feet]—an increase of 7·54 per cent. on the previous year. The average gross calorific value was 5150 calories [579 B.Th.U.]. There were carbonized 137,185 metric tons of coal; 11,500 cubic feet of gas being produced per ton. The gas consumption amounted to 44,649,180 cubic metres, or 7·34 per cent. higher than in 1912. Of the whole amount, 9·96 per cent. was used for public lighting, 84·94 per cent. sold to consumers, 1·81 per cent. used on the works, and 3·29 per cent. unaccounted for. The consumption per head of the population was 123·8 cubic metres [4372 cubic feet]. The meters in use increased by 4609, to 80,602, of which 32·74 per cent. were prepayment. The number of flat-flame burners in use was 36,425, and incandescents 106,928. Satisfactory increases are shown in all domestic gas-consuming apparatus, and gas-engines decreased in number, while increasing considerably in horse-power. The price of gas is about 3s. 1d. per 1000 cubic feet, with discounts of 5 and 10 per cent. for larger consumers.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Calorific Values.

SIR,—I am indebted to you for the reference to Mr. Herring's tables in your issue of July 31, 1906. In Table "A," if the first fifteen sets of tests (gas below 16·3 candles) be averaged at 15 97, and the British thermal units be also averaged for the same number, giving 589½ B.Th.U., this on the average of 15·97 candles works out at 36·91 B.Th.U. per candle, and the average I deduced from "Field's" returns for this year (for gas as is supplied in London) was 36 86.

I do not think I need comment further. I proposed to lay down no law; I pointed out the correspondence, which further experience confirms.

HY. E. JONES.

July 8, 1914.

Reflections from "Field's Analysis."

SIR,—While very much appreciating "Engineer's" contribution appearing on p. 1037 of your issue of June 30, furnishing his helpful and valued reflections from "Field's Analysis" (a work in which I have always taken considerable interest), for obvious reasons I desire to point out that, apart from any particulars as to the quality of the "gas made per ton," the first column of Table A loses its value.

If the make per ton given in the table be reduced from the illuminating power given in "Field's Analysis" to one common standard (say, that of the undertaking placed at the head of the list, 13·422 candles)—and for this purpose I have only taken the first four and the last of the undertakings given—the result is that the make per ton of these five concerns stands in the following order:—

Hornsey	(1)	13·560 C.P.
Commercial	(2)	13·472 ,,
Tottenham	(3)	13·164 ,,
Bristol	(4)	12·721 ,,
Croydon	(5)	12·696 ,,

D. IRVING.

Gas Company, Bristol, July 10, 1914.

The Gas Research Fellowship Report of Mr. Hollings and Professor Cobb.

SIR,—With regard to the Gas Research Fellowship report of Mr. Hollings and Professor Cobb, presented at the recent meeting of the Institution of Gas Engineers, the point raised by the authors on p. 918, col. 2 of the "JOURNAL," as to the difference in degree and sign of the value *x*, I should consider was within the limits of experimental error. The amount involved is such a small percentage of the total that a very slight error might change the sign as well as the amount. I do not consider that the benefit derived from such work is in determining whether the heat of carbonization is *plus* or *minus*, but in the larger problem of determining where our greatest losses have been, and what, from a practical standpoint, can be done to eliminate such losses.

In the paper which I read before the New England Association, a copy of which is found in the "Proceedings" of 1909-10, p. 222, there is embodied another thermal balance-sheet (of which I enclose a copy), of a second regenerative setting with outside producers. The data for this balance-sheet were obtained in the same manner as the data in the paper read before the New England Association in February, 1906, but on a much more highly developed setting. It will be noticed that the heat of formation *minus* is substantially the same as in the first balance-sheet, and that the gross heat of carbonization is substantially the same.

While the authors have determined the effect of rate of carbonization upon the heat absorbed or evolved, I sincerely hope that at some future time they will take up the problem of the effect of rate of carbonization upon the volume and composition of the gas up to (say) 2000° Fahr., which, if done in connection with their experiments to determine the influence of red-hot coke and radiant heat on the gaseous products of carbonization, would give us information that would show what are the limits in regard to volume and quality of gas which may be obtained from a ton of coal—a question that has never been determined experimentally, nor shown practically.

DANA D. BARNUM.

Worcester Gaslight Company, Mass., July 1, 1914.

[ENCLOSURE.]

THERMAL BALANCE-SHEET.

	B.Th.U.	Per Cent.
Expended 15·3 lbs. coke	195,519	82·6
Heat of formation *plus*	40,539	17·4
	236,058	100·0
Accounted for:—		
1. Carried up the chimney	41,165	17·3
2. In ashes	134	·06
3. Carried by gas	14,586	6 00
4. Carried by tar	4,230	1·7
5. Carried by hydroscopic water	3,759	1·5
6. Carried by water formed	8,979	3·7
7. Lost by radiation and convection	82,643	35·0
8. In the hot coke	33,396	14·1
9. Heat of formation *minus*	3,966	1·7
10. Balance (gross heat carbonization)	44,779	18·9
		100·0

Net heat carbonization per 1 lb. coal is 82·06 B.Th.U.

The Tendering for the Tottenham Gasholder.

SIR,—Early in the year, the writer was introduced to the officials of the Tottenham Gas Company, and was promised an opportunity to submit bids for their holder. We took such request as a compliment as to the good work we have done in the past for various friends.

In order to reciprocate the courtesy of the Company, we sent one of our best men to England to handle it. Our representative was treated with every possible courtesy, and extended all proper facilities by the Company, and in a way that was most businesslike and honourable.

We regret that anyone has seen occasion for criticizing the way the bidding was conducted. In our long experience in tendering for work under such conditions, we have never been treated more squarely, nor received a more favourable impression of the methods of those of whom we were soliciting business.

Pardon us if we ask you to publish this letter, but we feel it is only proper that those who have read the prior comments in your paper should have our testimony as to what took place.

R. D. WOOD.

Philadelphia, U.S.A., July 3, 1914.

P.S.—Perhaps our situation will be clearer to those who read the above if we state that we failed to secure the contract, and are among the losing bidders.—R. D. WOOD and Co.

Neath Gas Affairs.

SIR,—With reference to the paragraph in last week's "JOURNAL," on "Neath Gas Affairs" [p. 54], I am afraid it is misleading; and in justice to the majority of the Gas Committee, and also the members of the Town Council, it is necessary to make an explanation.

In common with most gas undertakings, we are suffering from the effects of the black coal strike of 1912. The increase in the price of coal has amounted to at least 3s. per ton; and, of course, all materials (including labour) used in gas-works have gone up. But we have managed to meet all our liabilities, and to spare; and during the last twelve months we have experienced an increased make of about 12 million cubic feet.

All our trouble has been caused by the importation of three new members on the Gas Committee, who have not scrupled to attack the gas undertaking in a most unfair manner, and have made a very serious attack on me personally. Without rhyme or reason they clamoured for an independent Auditor, on the ground of the elected Auditors being a sham. This was repeated, until I asked the Mayor to appoint an outside Accountant, which was done—a firm of Accountants being finally selected. The accounts were thoroughly examined, and the result was, as generally expected, they were found correct. But they were thought inadequate, which I consider is a matter of opinion.

The wiseacres were disappointed, as it was thought that something was very wrong, and possibly there were a few thousands floating about which up to now has not been located. They are having a warm time from the natives, as the Accountants' fee was about £100. A Financial Clerk is to be appointed, which should have been done some time since, as my duties and responsibilities are increasing, and I have to prepare the yearly statement of accounts.

The examination of the accounts was a minor detail; but the serious trouble came when the Gas Collector, whose health has been affected for some time past (an attack of nerves), left the town without warning. This, and not leaving his receipt books at the office, caused us the greatest amount of trouble, which was the real cause of the Accountants being called in to help to put matters right. But, as mentioned in your paragraph, the Collector has now been re-instated.

I must apologize for making this statement, as it is most repugnant, but I feel it is only due to myself and to my many friends in the gas profession.

ROBT. ALEX. BROWNING.

Gas-Works, Neath, July 10, 1914.

Sulphate of Ammonia Prices.

A PROVINCIAL CORRESPONDENT, writing on the 7th inst., says: "It may be of interest to you to know that I yesterday received for a parcel of 20 tons of sulphate of ammonia £10 10s. 3d. per ton, less 3½ per cent., naked, my works. It certainly tends to prove that there is a good upward move in the market."

Bolton and the Darwen Water Supply.

At a meeting of the Bolton Town Council last Wednesday, Alderman Parkinson (the Vice-Chairman of the Water Committee) was questioned as to the reason why the Water Committee had declined an offer by the Darwen Corporation to forfeit for a term of years 200,000 of the 300,000 gallons of water which the Bolton Corporation are compelled by the Act of 1905 to supply daily to Darwen. It was urged that, in view of the depleted state of the reservoirs, this concession by Darwen would have been useful to Bolton, and Mr. Ritson suggested that the reason for the refusal of the offer was that the Bolton Water Committee were trying to take revenge upon the Darwen Corporation for having succeeded in getting the provision embodied in the Act. Alderman Parkinson denied that there was any quarrel with Darwen; stating that the 200,000 gallons offered by Darwen was only 2 per cent. of the total daily requirements of Bolton, and was not worth considering. Writing later, however, our Manchester correspondent says that the Bolton Water Committee have been able to make arrangements with the Corporations of Manchester and Bury in regard to the seriously depleted condition of the Bolton reservoirs. Both the towns named have supplies more than adequate for their own needs. Connections have been made with the mains of these authorities; the water coming in the one case from Thirlmere, and in the other from the Ogden and Scout Moor reservoirs. The Manchester supply will be tapped when the necessity arises; but the drawing of water from the Bury mains has commenced.

At the Blackpool Town Council meeting last Tuesday, Alderman Battersby, the Chairman of the Gas Committee, referring to the death of Mr. John Chew (who had been the Gas Manager for the long period of 52 years), said his services had been such as they were proud of. During Mr. Chew's connection with the department, it had handed over to the rates no less a sum than £335,000.

REGISTER OF PATENTS.

Heating Retort-Furnaces.

DESSAUER VERTIKAL-OFEN-GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, of Berlin.

No. 7338; March 23, 1914. Convention date April 14, 1913.

In explanation of their invention, the patentees state: In the manufacture of gas, the retorts are generally heated with producer gas which is as a rule generated in the producers forming part of the retort-settings. It has been also sometimes suggested to use lighting gas generated from coal for heating the retorts; more particularly when the high price of coke renders the employment of coal advisable and economically possible.

When producer gas and lighting gas are alternately used at will, it is comparatively easy during the working to change from the producer gas to lighting gas for heating the retorts; but when it is desired to change back to the use of producer gas, difficulties at once arise, as during the heating by lighting gas the generators are stopped, and must be first heated again if the producer gas is to be used once more to heat the retorts. Moreover, in existing arrangements for heating, either with producer gas or lighting gas, there is a danger of explosion, since in the case of heating by lighting gas the latter can pass through leaky portions of the slide valves into the inoperative generator or producer and into the adjoining supply conduits for the producer gas and thus form an explosive gas mixture with the air contained therein.

According to this invention, these drawbacks are obviated by the generator or producer, instead of being completely stopped during temporary heating of the retorts with lighting gas, being allowed to generate as much producer gas as is required to ensure the generator and the adjoining supply conduits for the producer gas remaining hot. The producer gas so generated is burnt in the combustion chambers of the retort-furnace or previously mixed with the lighting gas used for heating the retorts, and then burnt with it in the retort-furnace.

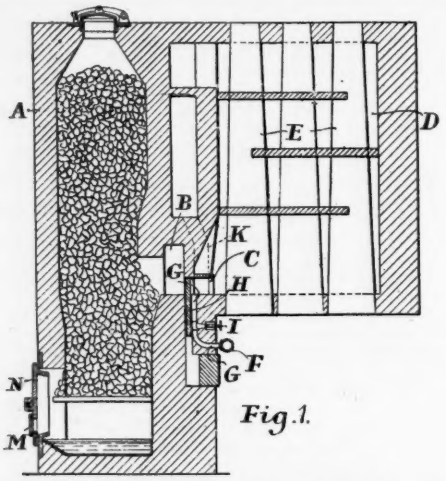


Fig. 1.

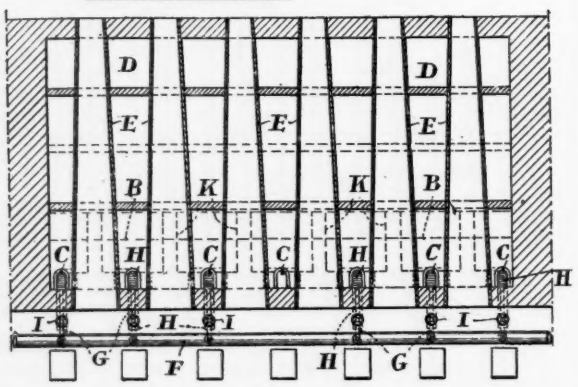


Fig. 2.

Dessau Company's Gas Retort-Heating Arrangement.

According to this method, heating may be carried out at will in either of the following manners: 1. When heating exclusively with producer gas, the conduits supplying lighting gas to the combustion chamber of the retort-furnace are closed, while the undergrate air-valves or dampers regulating the admission of combustion air to the generator are fairly wide open. 2. When heating with lighting gas, the conduits for the supply of lighting gas, leading to the combustion chamber of the retort-furnace, are opened to the required extent, and the undergrate air-valves for the generators are opened only to a slight extent, so as to supply the undergrate air required for generating a small quantity of producer gas. When carrying out this method, it is possible to pass, without any difficulty, from lighting gas heating to heating with producer gas, by closing the lighting-gas supply conduits and opening wide the undergrate air-valves. Both methods of heating are therefore quickly ready for use, and can be alternated as frequently as desired.

The illustrations show an arrangement for carrying out the method last mentioned in a vertical-retort furnace, in such a manner that when heating with lighting gas, only one of the connecting conduits between the producer and the furnace-chamber is permanently open. Fig. 1 is a cross-section of fig. 2; and fig. 2 is a vertical section of fig. 1.

The producer A is connected by a transverse conduit B and lateral conduits C (adjoining it and arranged beside each other) to the retort-setting D, in which are the retorts E to be heated. From the main pipe F, arranged below the furnace-chamber, are carried upwards, for the purpose of supplying lighting gas, branch pipes G, which open behind the valves or dampers H into the lateral conduits C, and can be opened or closed as required by means of valves I. The supply of combustion air is effected through rectangular conduits K opening into the lateral conduits C. The undergrate air for the producer is supplied through the slide valve M in the bottom door N of the producer.

In the construction illustrated, only the three right-hand and the three left-hand lateral conduits C are connected to the lighting gas supply pipe F, by branch pipes G, which can be shut off; while the central conduit C is not connected to the pipe F, but is in open communication with the transverse conduit B for the supply of the producer gas. The plant is therefore such that during the lighting-gas heating, six heating conduits C are supplied with lighting gas from the main pipe F by means of the pipes G, while the central conduit C admits producer gas into the furnace-chamber D. Six-sevenths therefore of the heating requirements of the furnace are supplied by lighting gas, and the remaining one-seventh by producer gas.

As in this construction, during the lighting-gas heating, producer gas can only pass into the retort-setting through C, this narrow conduit produces a comparatively great resistance, which prevents the excessive generation of producer gas even during the removal of clinker from the producer. It will be understood that the arrangement may also be such that during the lighting-gas heating, two or more supply conduits C, for the producer gas, are connected to the retort-setting when a correspondingly large portion of the heating has to be effected by the producer gas. By connecting or disconnecting a certain number of conduits E and F to the retort-setting, the heating can be regulated in a very simple manner.

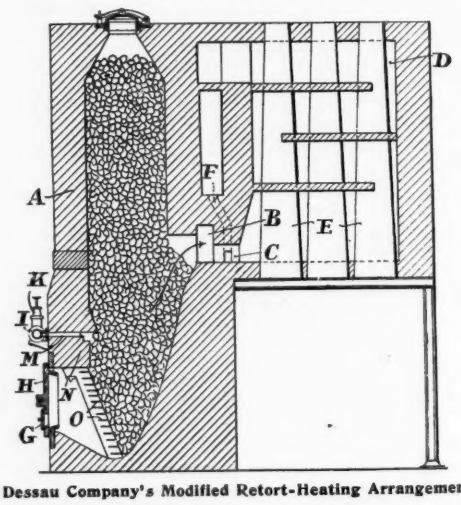
Heating Retort-Furnaces.

DESSAUER VERTIKAL-OFEN-GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, of Berlin.

No. 7466; March 24, 1914. Convention date Nov. 1, 1913.

This invention is a modification of that described above—No. 7338 of 1914—and is illustrated in vertical section.

The furnace is provided (as in the previous construction) with a producer A connected by a transverse conduit B and by lateral conduits C, arranged beside each other, to the retort-setting D, in which are placed the retorts E to be heated. The supply of combustion air takes place through conduits F opening into the lateral conduits, and the air required for generating the producer gas is supplied through the lower door H of the producer by the slide or damper G.



Dessau Company's Modified Retort-Heating Arrangement.

The lighting-gas pipe I is provided with a valve K, disposed in an accessible position in front of the producer. To the pipe are connected horizontal conduits M carried through the wall of the producer. The outlet openings N of these conduits are at such a level above the grate O of the producer that there is an incandescent layer of fuel between the points of admission into the producer of the undergrate air and of the lighting gas. Consequently the undergrate air cannot come into contact with the lighting gas introduced into the producer.

When heating by producer gas, the valve K is closed while the slide or damper G regulating the supply of combustion air to the producer is open fairly wide, so that the quantity of producer gas required for working the furnace can be generated. In heating with lighting gas, the undergrate air-slide G is slightly opened, so that only a small quantity of air is supplied, and only such a quantity of producer gas is generated that the fuel in the producer is maintained incandescent. The lighting gas used for heating the furnace passes from the conduits M, through the incandescent fuel, into the conduits B C, whence it finally passes into the heating-chamber D, after having been mixed with the slight quantity of producer gas generated in the producer. In passing through the incandescent fuel the gas is deprived of its lighting ingredients; "so that no illuminating flames, rendering observation of

the furnace temperature difficult, are produced in the retort or heating-chamber."

In the construction illustrated, the valves are omitted which were provided in the furnace-conduits C in the construction described in the main patent, so as to avoid excessive generation of producer gas while heating by means of lighting gas during the removal of clinker from the producer. In the present case, the supply of lighting gas during removal of clinker from the producer is almost completely shut off by the valve K, so that an excessive quantity of gas cannot get into the chamber D. The shutting-off of the gas supply pipe I during the removal of clinker can take place automatically by connecting the producer door H, by means of rods, to the valve K, or to another valve so placed in the pipe I that on the door being opened the valve is practically or completely closed.

This method for heating retort-furnaces it is claimed also "makes it possible to use, for heating the retorts when the gas producer is practically inoperative in place of ordinary lighting gas, some other heating gas which gives off light in burning. For instance, the brown-coal producer gas, which has been lately manufactured in large quantities in a very economical manner, may also be completely deprived of its lighting ingredients by passing it through the incandescent layer of fuel in the producer according to this invention, so that it forms no illuminating flames when burnt in the heating-chamber of the furnace."

Inverted Gas-Burners.

DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (AUERGESELLSCHAFT), of Berlin.

No. 21,458; Sept. 23, 1913. Convention date, Sept. 27, 1912.

In inverted gas-burners for lamps having a practically closed combustion chamber, and in which the air required for the combustion is drawn in partly by the injector action of the gas-jet and partly by a chimney draught acting upon the mixing-tube, the patentees propose an arrangement according to which the intermediate tube placed below and opposite the gas-jet projects a short distance into a wider space provided with air-admission openings through which additional air is drawn in by the aid of the chimney draught.

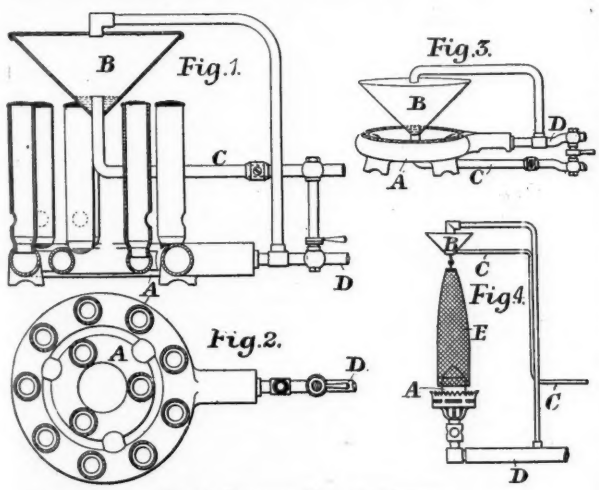
One construction of the invention as applied to a petroleum inverted incandescent lamp is shown in the specification; but, as the patentees remark, the invention is not restricted to the illustrated construction, and may be employed not only for petroleum vapour inverted incandescent lamps but also for other inverted incandescent lamps in which gases rich in hydrocarbons are used. The improved construction may also be used for poor gases—for instance, ordinary lighting gas, for the purpose of producing at a low pressure in the mixing-tube itself a mixture rich in air before the entrance into the flame.

Pressure Blast Gas-Burners.

MANN, J., of Harrow-on-the-Hill.

No. 12,219; Nov. 26, 1913.

This invention relates to gas-burners of the type in which a pressure blast is automatically maintained by means of steam generated by the heat of the gas-burner itself. In such burners it is usual to arrange a continuous and regulatable supply of water to the steam-generator and to connect the generator by a pipe to the burner so that the gas and steam mix together and escape through the burner-jets where combustion takes place.



Mann's Pressure Blast Gas-Burners.

Figs. 1 and 2 are a side elevation and plan of one construction of burner according to the invention. Fig. 3 is an isometric view of a modified form of burner. Fig. 4 illustrates the application of the burner to a high-pressure incandescent gas light.

In figs. 1 and 2 the burner-ring A has upright tubes mounted on it, with air inlet apertures provided with gauze covers. Over these burners is the inverted conical generator B, into which the end of the water supply pipe C projects a short distance so as to always maintain a small quantity of water in the generator. The pipe from the top of the generator is connected to the gas-pipe D, where the products from the generator mingle with the gas and pass to the burners where combustion takes place—"resulting in a high pressure flame of great intensity and efficiency." In the gas-pipe is the usual valve or cock, which is interconnected by its spindle with a water-regulating valve in the water-pipe C; the two valves being simultaneously operated by a single tap or lever on the spindle. A variable cock is provided in the water-pipe which may be regulated independently by means of a screw.

Fig. 3 shows a form of burner in which the upright tubes are dispensed with and the upper surface of the burner-ring is perforated with a number of fine holes or else covered with wire gauze or other porous material. In this case the air inlet is on the arm to which the gas connection is made; the position being such that the air is admitted to the mixture of gas and the heated products from the generator, after the latter have mingled.

Fig. 4 illustrates the application of the burner to a high-pressure incandescent light, in which the generator B is mounted on the end of the pipe through which the products from the generator pass to the gas-pipe D, and thence to the burner A, where combustion takes place, rendering the mantle incandescent. The same regulating means may be used on this device as on the two previous burners.

Device for Giving an Alarm and Lighting a Gas Jet and Fire.

KENYON, W., of Blackburn.

No. 26,963; Nov. 24, 1913.

This invention relates to apparatus "for automatically lighting a gas-burner and automatically lighting a fire already laid for the purpose, and at the same time giving an alarm." It has for its object the turning on automatically of a gas supply to a bunsen burner or the like over which (say) a kettle may be placed, and at the same time automatically turning on a supply of gas to ignite combustible materials placed in a fire-grate so as to start a fire, and subsequently turning out such gas supply after a short time, and at the same time giving an alarm—the automatic arrangement being actuated by an ordinary alarm clock mechanism or the like. The patentee says he is aware that devices of a somewhat similar nature are already in use, but they have only been applied to giving an alarm, and automatically lighting a gas burner for the heating or boiling of liquids; while another device has been proposed comprising a burner supplied by means of a flexible tube and fitted with a hook for fixing to the bars of a fire-grate for the purpose only of lighting a fire. The novelty of his invention resides in the fact that he arranges to automatically light a fire in addition to giving an alarm and lighting a bunsen burner.

Water-Heating Apparatus.

JUNKERS, H., of Aachen, Germany.

No. 29,892; Dec. 29, 1913.

This invention relates to water-heating apparatus ("geysers"), and is a modification of the apparatus described in patent No. 15,196 of 1913, with the object of lightening the apparatus and thus still further reduce the strain on the support.

The apparatus is adapted to be suspended against a wall, and is substantially kidney-shaped in cross section with the hollow side turned towards the wall. The heating chamber is surrounded by a jacket, through which the liquid to be heated flows; and to enable this jacket to stand the pressure, the use of strong material is necessary, and so the heater is comparatively heavy. The support therefore has to bear a not inconsiderable strain, though not so much as with liquid heaters of circular section.

According to the present invention, the strain on the support is still further reduced because, in place of the liquid chamber being formed as a jacket surrounding the heating chamber, the liquid is conveyed by tubes mounted on a shell forming the heating chamber in such a manner that the heat is conducted to them—such shell having one of the sectional shapes (or approximately so) described in the earlier specification. These tubes, it is said, "can be made so strong, as far as resistance to pressure is concerned, with a much smaller consumption of material than in the case of a jacket, that they will effectually stand the pressure of the liquid, on which account the liquid heater is lighter and the strain on the support is further reduced."

APPLICATIONS FOR LETTERS PATENT.

15,498.—ROSE, A., BELLAMY, W., and DOLPHIN, J, "Atmospheric burners." June 29.

15,561.—GIBBONS, W. G., and W. J. JENKINS AND CO., LTD., "Projectors for coal." June 29.

15,619.—DEMPSTER, R., AND SONS, LTD., and HARGREAVES, W., "Telpher tracks." June 30.

15,728 —MACKNESS, W., "Automatic gas-waste preventer." July 1.

15,730.—STIMSON, E. F., "Gas-heated hot-water circulators." July 1.

15,814.—WEBB, M. J., "Gas-detectors." July 2.

15,830.—GORDON HARVEY COMPANY and PYNEGAR, H., JUN., "Dry quenching of coke." July 2.

15,892.—LAMPLOUGH, F., "Low-temperature distillation of coal." July 2.

15,898 9.—KING, J., BURNETT, J. R., and RICHMOND GAS STOVE AND METER COMPANY, LTD., "Gas-heated furnaces." July 3.

15,978.—WILSON, W. A., "Gas-fires." July 4.

16,044.—SULMAN, H. L., and PICARD, H. F. K, "Cleansing gases." July 4.

Bolton Gas Engineer's Salary.—At the monthly meeting of the Bolton Town Council last Wednesday, Mr. Crowther moved that the salary of Mr. W. J. Smith, the Gas Engineer and Manager, be increased from £600 to £700, instead of to £800, as was resolved by the Gas Committee. Mr. Hinton seconded, and the amendment was carried.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Private Bills:—

The Gas Provisional Order (No. 2) Bill, Gas Provisional Orders (No. 3) Bill, City of London (Various Powers) Bill, and Hayward's Heath Gas Bill were brought from the Commons, read the first time, and referred to the Examiners.

The Select Committee on the Tees Valley Water Bill reported that they had not proceeded with its consideration, all opposition having been withdrawn. The Bill was committed.

The South Suburban Gas Bill and Leyland Gas Bill were reported with amendments.

The Market Rasen Water Bill, Bedwas and Machen Urban District Council Bill, Deal and Walmer Gas and Electricity Bill, and Gas and Water Provisional Orders (Nos. 1 and 2) Bills were read the third time and passed.

The Commons' Amendments to the Mexborough Urban District Council Bill, Llanfaelog Water Bill, and Rhymney and Aber Valleys Gas and Water Bill were agreed to.

The following Bills have received the Royal Assent:—

Inverness Water and Gas Order Confirmation, Clydebank and District Water Order Confirmation, Lanarkshire Gas Order Confirmation, Dundee Boundaries Extension and Gas Order Confirmation, South Bank and Normanby Gas Company, Cleckheaton Urban District Council, Abertillery and District Water Board, Stone Gas and Electricity, Bristol Water-Works, Kidsgrove Gas, Ashington Urban District Council, Llanfaelog Water, Rhymney and Aber Valleys Gas and Water, Barnsley Corporation, Mexborough Urban District Council.

HOUSE OF COMMONS.

The West Gloucestershire Water Bill and Liverpool Gas Company Bill were read a second time and committed.

The Brentford Gas Bill, Chelmsford Gas Bill, City of London (Various Powers) Bill, and Hayward's Heath Gas Bill were read the third time and passed.

The Lords' Amendments to the Barnsley Corporation Bill, Bedwas and Machen Urban District Council Bill, and Market Rasin Water Bill were agreed to.

The Alliance and Dublin Consumers Gas (Electric Supply) Bill has been withdrawn.

The petition of the East Ham Corporation against the Gas Light and Coke Company Bill and that of the Liverpool Corporation against the Liverpool Gas Company Bill have been withdrawn.

All opposition having been withdrawn, the Gas Light and Coke Company Bill has been referred back to the Unopposed Bills Committee.

A Question of Pure Water.

Major Guest recently asked the President of the Local Government Board whether his attention had been drawn to the repeated reports of the local medical officer of health as to the insanitary conditions of the water supply to the towns of Fishguard and Goodwick, and whether he intends to take any steps to compel the North Pembrokeshire Water and Gas Company to supply good water to the town. Mr. Herbert Samuel replied that his attention had been drawn to the matter, and he was sending a medical inspector and an engineering inspector to investigate the local circumstances.

LIVERPOOL GAS COMPANY AND CO-PARTNERSHIP.

On the motion for the second reading of the Liverpool Gas Company's Bill last Thursday,

Mr. CLYNES said he opposed the Bill; and he did so mainly on the ground that the promoters denied to the employees the right of organization and collective bargaining commonly enjoyed by men in similar occupation in other gas-works and in almost all trades and occupations. He complained that the Company were seeking to impose on the men conditions which amounted to servitude. A scheme of co-partnership had been drawn up without the workmen being informed that it was in preparation for them, and they objected to it being forced upon them. They were not opposed to co-partnership if the employers and workmen were real partners; but they objected to one side being required to accept without discussion terms decided upon by the other. Their complaint against the scheme was that the men were to sign a document binding them to work for the Company for such a period as might be determined, and that the rules abolished trade union intervention or service. He appealed to the House not to allow the Company to take from the lowly-paid manual workers the liberty conceded by Parliament more than forty years ago to be members of a trade union. How extremely moderate the demands of those he represented were might be seen by their enumeration. The first was that the Co-Partnership Committee should confine themselves to matters set forth in the rules of the scheme. The second was that working conditions, wage questions, and other grievances should be considered by a Board consisting of an equal number of representatives of the Company and of persons freely chosen by the workmen acting through their trade union. As to the scheme of that body, they would be quite ready to follow the usual practice of mutually agreeing to the appointment of some judicially minded man in whom both sides had confidence. Their last condition was that no duration of service should be imposed upon workmen unless it was a short term fixed to expire at one time, and not to be altered without the consent of the men by ballot. The men asked for no privileges, and the Company were entitled to none. He moved, as an amendment, that the Bill be rejected.

Mr. W. THORNE seconded the amendment. He said as a Socialist he objected to co-partnership. It was not on this ground, however, that he opposed the scheme, but because it was an unfair one. The Committee of twenty-four was to consist of twelve men elected by their fellow-workers; but these men were to have been five years in the service of the Company, and to have £25 invested in it. Such a monetary qualification practically barred-out the men who did the heavy work—the labourers. The other members of the Committee were to be nominated by the Board; the Chairman of the Company having a casting vote. What chance had the workmen of getting reasonable treatment in regard to wages and conditions of labour from a Committee of this sort? The wages paid to the Liverpool gas workers were much below those paid to other workers in different parts of the country; but he understood the Company were pledged to rectify this at the earliest opportunity. He hoped the Bill would be rejected unless the Company dealt fairly with this matter.

Mr. T. P. O'CONNOR asked the House to accept the second reading, and said he did not abandon hope that before the Bill passed into law there would be other opportunities of bringing the two parties together. The Directors had met the local authorities very fairly; and the sliding-scale of prices they had arranged would benefit the consumer by providing cheaper gas, and would also benefit the shareholders and the workers of the Company. The members of the Co-Partnership Committtee nominated by the Board were six, and there were also five Directors and the Chairman. It would not be just to suggest that the Board selected the members for nomination unfairly. The consideration of wages and conditions of labour was a natural development of the original purpose of the Committee. Not only were his countrymen in favour of the Bill, but the Committee had unanimously agreed to a resolution in its favour. He believed the Directors would be prepared to have a Conciliation Committee; but they could not agree to all the conditions Mr. Clynes wanted. In his opinion, the only demand the men could make to the employers was that they should preserve an attitude of neutrality as to the men joining or refusing to join a union; and the Directors assured him that they never brought any pressure on the men not to join the union, and that they never asked a man whether he was or was not a unionist. The Directors went further, and said that if a majority of the men joined the union they would accept the situation, and be ready to see the officials as representatives of the men. The majority of the workmen did not agree with what hon. gentlemen had stated as to the co-partnership scheme, and believed they were very fairly treated. For these reasons he thought he had made out a fair case for the House not to reject the Bill.

Sir. J. HARMOOD BANNER emphasized the statement of the last speaker in regard to the feeling of the Company's workers. The action of the Labour members was viewed with indignation. The co-partnership scheme gave unbounded satisfaction; and the Committee were willing to discuss any grievance relating to the workmen. The Bill was of great importance to the people of Liverpool; and if it was lost it would be very disadvantageous. It was now entirely unopposed by petitions. He thought it would be a very arbitrary exercise of the power of the House to reject a Bill which gave the people of Liverpool advantages, and also secured them for the Company's men, who had accepted the co-partnership scheme and liked it.

Mr. ANEURIN WILLIAMS, as a member for twenty years of the Labour Co-Partnership Association, said he very much regretted to find a conflict between trade unionism and co-partnership. There were more than thirty gas companies in the country with a total capital of £50,000,000 who practised co-partnership; and bonuses paid to the workers amounted to more than £1,000,000, a great amount of which was invested by the workers.

Lord R. CECIL said it was a dangerous precedent to establish that, in order to enforce some quite extraneous principle, a Bill which was desired by the people of the locality concerned should be rejected. It was a fallacy to suppose that co-partnership was in any way hostile to trade unionism. He maintained that it was inevitable that a co-partnership company must discuss questions of wages and conditions. There was nothing unfair in the agreement between the men and the Company. The men entered into it voluntarily because they believed it was to their advantage.

Mr. RAMSAY MACDONALD questioned the *bona fides* of the letters of gas workers protesting against the action of the Labour Party. He submitted that before a Bill was passed conferring further powers on directors it was perfectly germane to raise the question of general conduct. The conduct of the Directors of the Liverpool Company was now in question. He protested against them relegating to the Co-Partnership Committee the question of wages and conditions of labour.

Mr. MARSHALL HALL, K.C., said that if the facts were known it would be found that the hon. member for Leicester (Mr. Macdonald) was attempting to sacrifice the interests of the men in those of trade unionism. The co-partnership scheme had the undivided support of the men; but the hon. member seemed to consider the letters which had been quoted were bogus. What evidence would he accept as conclusive? He (Mr. Marshall Hall) had in his hand a resolution of the Co-Partnership Committee at which eighteen workmen were present and only five officials of the Company. After a free and exhaustive discussion, it was unanimously agreed that the scheme of co-partnership had given general satisfaction; that there was no compulsion exercised on men to sign the agreement; that the men were anxious to join; and that the Directors could rely upon the support of the men in protecting the scheme. The fact was that as early as 1911, as soon as the scheme was mooted, Mr. Clynes and Mr. Thorne went to Liverpool and agitated against it. The men attended these meetings; but the result was that they failed to dissuade them from taking advantage of the scheme. From that time forward no effort had been spared by the two hon. members to induce the workmen to give up the scheme; but the men would not toe the line of the Gas Workers' Union. As recently as the 29th of June, the Co-Partnership Committee unanimously passed another resolution, after free and full discussion, in which fourteen of the workmen's representatives took part.

The resolution again approved the scheme of the democratic constitution of the Committee and of the freedom of speech encouraged in the discussion of questions. He asked the House not to reject the Bill merely because the trade unions did not approve of co-partnership.

After some further debate, the House divided; and the motion for the second reading of the Bill was carried by 168 votes to 68.

PIPE SUBWAYS IN THE NEW WESTERN ROAD.

The Bill promoting the new western road out of London, which is to be constructed by the Middlesex County Council, was last Tuesday before the House of Lords Committee presided over by the Duke of Bedford. The Bill has already been dealt with by a Committee of the House of Commons [see "JOURNAL" for May 12, p. 440]. As on that occasion, the Brentford Gas Company opposed with regard to the provisions affecting the laying of pipes. In addition on this occasion the Gas Companies' Protection Association appeared; but their *locus* was successfully objected to by Counsel for the Bill.

Counsel appearing for the Bill were Mr. HONORATUS LLOYD, K.C., Mr. G. J. TALBOT, K.C., and Mr. WROTTESLEY. The Brentford Gas Company were represented by Mr. BALFOUR BROWNE, K.C., the Hon. EVAN CHARTERIS, Mr. ARTHUR MOON, and Mr. F. S. BAKER; the Gas Companies' Protection Association, by Mr. A. M. PADDON.

Mr. HONORATUS LLOYD, in his opening speech, remarked that the road is to be constructed of reinforced concrete on a strong foundation, with wood blocks above; the object being to make it so durable that the foundations will never have to be taken up, and that only the top layer will require to be renewed from time to time. With the object also of preserving the foundation of the roadway, and also the amenities of the road generally, it is proposed that no mains or pipes shall be laid under the surface of the carriageway, but that they shall all be relegated to the footpaths. Referring to the Brentford Gas Company's petition, Counsel said this took exception to a number of clauses under which it was alleged that the County Council would interfere with, and hamper the business of, the Company. All, however, that was intended by the Bill was to prohibit the roadway being broken up, and provision was made for laying the mains in the footpaths, and also for the construction of culverts across the road where the mains now exist. For any future mains that would have to be laid, however, the Gas Company would have to pay for the additional provision. The same applied to water and electricity mains. Every provision would be made for dealing with the existing works; but for future mains the authorities owning them would have to bear the expense. Reading the petition, said Counsel, it might almost be imagined that the County Council were desirous of spending public money to construct a new road, and that in doing so they intended to do irreparable injury to the Company. As a matter of fact, there were clauses in the Bill with the very object of preventing this taking place. Whatever the Council might have to do in the way of altering or removing pipes, they would have to pay the Gas Company full compensation. The ordinary provision was made for allowing the Gas Company full access to their mains; and he submitted that the proposals were fair and expedient. With regard to the Gas Companies' Protection Association, this was established for the purpose of protecting the rights, powers, privileges, and properties of gas undertakings generally; but the position as regards this Bill was this: The Brentford Gas Company belonged to the Association, and was the only gas company supplying in the area in which the road would exist. Consequently, the petition of the Association would seem to be an attempt to push behind the Brentford Gas Company, and say twice over what the Gas Company would no doubt say for itself. He objected to the *locus* of the Association on the ground that it had nothing whatever to do with the supply of gas in the district, and that it was not interested in any way whatever. The Association claimed *locus* under Standing Order 105B, which gave any person interested in the district the right to appear against a Bill, subject to the discretion of the Committee. But they had no business interests whatever in the district; and if the Committee were to allow *locus*, it would seem to create a precedent that practically any person could oppose any Private Bill.

Mr. PADDON said the Association not only represented statutory gas companies throughout the length and breadth of the country, but it also had in its membership seven or eight gas companies carrying on business within the County of Middlesex. He therefore claimed that it was an Association interested in the district. The Bill sought to subvert and change the general law under which all gas companies carried on their business, and must enormously injure them in the future. It was a serious thing for gas companies that a road authority should be able to alter the general law in respect of a new road of this character, so as to prohibit the laying of gas-mains under the carriageway. This rendered nugatory the clauses of the Acts of 1847 and 1871, under which all gas undertakings had hitherto been carried on, and in connection with which they were subject to heavy monetary penalties. Therefore, by reason of this desire to change the general law, and also by reason of the facts he had already mentioned as to the membership of the Association, he claimed a right to be heard before the Committee. It was an important matter for the gas companies, because the development in modern traffic upon roads was such that gas undertakings must again and again in the future be face to face with this question of new roads. The Brentford Gas Company in their opposition would of necessity deal with matters of detail affecting their own undertaking; but he desired, on behalf of the Association, to deal with matters of broad principle affecting the gas industry as a whole.

The Committee decided that the Association should not be heard.

Wednesday, July 8.

Mr. *H. T. Wakelam*, the Engineer to the Middlesex County Council, on the question of the gas-mains, said he thought it would be rather cheaper from the point of view of the Gas Company to lay their mains under the footpaths.

The Hon. EVAN CHARTERIS, cross-examining, said it was essential that there should be room under the footway for all pipes that might be required to be put there; and if the Council's scheme was defective in this respect, it would require reconsideration. Witness maintained that the scheme was not defective, but agreed that if it could be proved that it was so the whole matter would require reconsideration. Counsel pointed out that with regard to the Uxbridge Road the Brentford Gas Company had power to break-up the carriage-way under the Gas-Works Clauses Act, and therefore they should have this power with regard to the proposed new road. He asked what size pipes had been allowed for in the footpaths of the new road, and witness replied 15 to 18 inches. He added that it must be remembered that electricity undertakings were also supplying in the district, and there would not be so much need for gas as there would be if no electricity undertakings existed. Within the last ten years along the Middlesex roads they had diverted gas and water mains at a cost of £68,000; but they had never met with gas-pipes of more than 18 inches diameter. In regard to the transverse roads, there were twenty-one of these which would cross the new road, all of which contained gas-mains at the present time, and three more where there were no mains. It was proposed to construct subways to carry existing mains at the cross roads where mains already existed, but not at the roads where mains did not exist. If, however, the Company laid mains in the future in the remaining three roads, if they gave six months' notice to the Council the latter would carry out the work of erecting subways at the Company's cost. Counsel, however, expressed the opinion that the Council were trying to force the Gas Company into a capital expenditure which would enable them to deal with any development hereafter, which was an entire revolution of the general law.

Mr. WROTTESLEY, re-examining on behalf of the promoters, said that until the road had been completed and dedicated to the pubic no authority had power to lay mains; and therefore the Council were saving the Gas Company the expense of breaking-up the street in order to lay their pipes. Witness remarked that the Company wanted to lay trunk mains along this road, but the Council were of opinion that if they desired to lay the pipes they should carry them along the other roads where they are at present.

Alderman *Charles Pinkham*, the Chairman of the Highways Committee of the Middlesex County Council, gave evidence on behalf of the promoters.

Mr. BALFOUR BROWNE, cross-examining on behalf of the Gas Company, said that if he had to put the pipes in the pavement on either side, they would have to be duplicated; whereas if they were in the centre of the road this duplication would be avoided.

Mr. WROTTESLEY, in re-examination, pointed out that, though there would be two lines of pipes, the services would be shortened.

Thursday, July 9.

The case of the Brentford Gas Company was considered this morning.

Mr. *A. A. Johnston*, the Engineer and Manager of the Company, said that at present the Company had the right, under the Gas-Works Clauses Act, to take a main down any road, and to use the roadway without payment for this purpose. Having regard to the fact that the Bill forbade the laying of pipes in the roadway, it was essential that there should be ample accommodation provided under the footway. The pipes which witness estimated would be required along the new road to meet future developments were one 30-inch main along each side, together with a 12-inch service-pipe, which would be fed from the 30-inch main and tapped for the supply to various houses; whereas the County Council had only allowed accommodation for a 15-inch main on each side of the road. Mr. Wakelam, the Engineer to the Council, had said that he did not think it possible to make an estimate of the gas which would be required along this road in the future; yet he had asked the Gas Company to state within six months what the development would be on the south side of the road, so as to provide subways sufficiently large to carry the pipes to supply this area in the future. All the gas required in future would have to come from the Southall works, which were on the north of the new road, even to supply the district in the south; the Brentford works being already congested.

Mr. TALBOT, cross-examining, pointed out that someone must determine now what size the subways across the road should be; and as the Brentford Company was the gas authority in charge of the district, they were the people best able to say what accommodation was likely to be needed in the future. Witness said that the only way to overcome this difficulty would be for the County Council to provide something which would be amply sufficient for the future; but Counsel remarked that this was rather fantastic. Witness, however, said that the Gas Company might be forced into an expenditure which would not perhaps be necessary for future requirements. Counsel said that this road was quite different from other roads. The Middlesex County Council were buying the land freehold, and now the Gas Company wanted to break it up. Witness maintained that it was bought with public money, and added that Mr. Talbot was not taking into account the necessities of the public. With regard to the question of sufficient room being allowed under the footway, witness held that if the mains were laid in a proper and defined way there would be sufficient space. If a plan which had been defined by the Metropolitan Water Board, who were also opposing the Bill in this connection, was adopted, then he thought it could be done. The point was that the Gas Company was given no assurance that there would be sufficient accommodation available. Counsel suggested that the large pipe which it was stated would be required for the supply of this road would be utilized for the supply of districts further on. Witness said that the road would be supplied from these mains; but a main could not be laid specially for every road—otherwise a gas-works would be required in every street. With regard to the point that if more land had to be bought to widen the footpaths in order to accommodate the mains the County Council should pay for it, Counsel did not think this a fair provision, especially as the Metropolitan Water Board had agreed to pay for additional land required in this connection. Witness, however, pointed out that the Gas Company were not the only people laying mains in the footpath.

The Hon. EVAN CHARTERIS, re-examining, said that it was stated

the previous day by Mr. Wakelam that if it could be proved that the proposals with regard to the footways were inadequate, the scheme would require reconsideration, and Mr. Johnston had said that they were inadequate. The Gas Company were willing to waive the necessity of the 12-inch main. In the Uxbridge Road there was a 30-inch main on each side of the road. These would soon be insufficient, and, therefore, as this road was likely to develop to a considerable extent, this was not an extravagant proposition.

Mr. *Henry E. Jones* expressed the opinion that if the Bill was passed in its present form it would make it difficult for the Gas Company to carry out their statutory obligations. He did not think it right that the question of space for the pipes should be left to the sweet will of the Middlesex County Council.

The CHAIRMAN asked whether the objection was to the words "so far as they conveniently can" in the clause permitting the laying down of pipes under the footway, and suggested that an agreement could be come to.

Witness said that if the County Council would consent to an arbitration the difficulty would drop.

Continuing, witness upheld the opinion of Mr. Johnston that a 30-inch pipe would be necessary on either side of the road in order to supply the population in the immediate vicinity of the road.

Cross-examined by Mr. TALBOT, witness said that if the scheme drawn up by the Water Board was adopted, he thought there would be sufficient room for all pipes under the footways. This provided that there should be a 42-inch water-main on one side of the road, and a 42-inch gas-pipe on the other; but witness stated that there must be a 12-inch pipe on the footway opposite to the 42-inch main. Gas companies always laid two pipes in a road when they had a chance.

The CHAIRMAN said that, with regard to clause 19, dealing with the laying of pipes during the construction of footways, this only applied while the road was being made. When the road was made, the Company would have powers under the General Acts.

Mr. MOON, for the Gas Company, answered that there would probably not be room for the pipes.

Mr. *Henry Woodall* said that if definite plans were not adhered to with regard to the laying of mains, someone would be held-up. He agreed with the proposition put forward by the Water Board. With regard to the cross roads, he suggested that there should 48-inch pipes at these points, and then thread the smaller mains through them.

In cross-examination by Mr. WROTTESLEY, witness said that, with regard to the cross roads, where there were no pipes at present existing, the expense should be shared. Counsel thought that the Company would be saved the cost of breaking-up and reinstating the road, and keeping the reinstatement in repair for twelve months. Witness, however, said he would rather have the pipes in the ground than in subways, as brackets would have to be provided by the Company to support the pipes. It was pointed out, however, that the County Council were providing these supports. If more land was required for the accommodation of pipes, witness did not think the Company should pay for it, having regard to the fact that the Council were turning the Company out of the road.

In cross-examination by Mr. BALFOUR BROWNE, witness said that when subways were used for carrying gas-pipes there was some fear of explosion.

Mr. BALFOUR BROWNE, addressing the Committee on behalf of the Gas Company, said he had got privileges from Parliament to break-up streets, and had been put under various restrictions for the benefit of the public. One of the privileges the public had derived was that the Company was in a sense a partner with the consumers. With regard to the question of the County Council having a road which could not be interfered with, the Company sympathized with them, but having regard to this, the County Council should be bound to give adequate room for the pipes. The object of the road was not merely for carrying people to and from London, but also to develop the district. The road would eventually become a gash in the Gas Company's area, which they could not cross in the future. There was no objection to the provision of subways for carrying gas-mains across the road, except that the gas engineers did not like subways, on account of them not being safe. The Company would be quite willing to lay a pipe under the roadway without disturbing the surface. It was said, however, that if the district developed the Gas Company should pay the extra expense, and Counsel submitted that this was a tax the County Council could not impose. In consequence of this, the Council had asked him to estimate the development of the district in the future, which could not be done. He therefore asked that the Gas Company should remain in the same position as before the promotion of the Bill.

Friday, July 10.

Mr. HONORATUS LLOYD, addressing the Committee on the gas opposition, said he could not help thinking that the Gas Company had misunderstood altogether the meaning of clauses 18, 19, and 20, to which objection had been taken. The Company seemed to be under the impression that the County Council were desirous of depriving them of something which they possessed under the ordinary law; but he could not see anything they had to complain of. The only thing the Gas Company were being deprived of was the right to break-up the roadway as opposed to the footway. But, curiously enough, this proposal was not objected to—indeed, the Company agreed that it was a desirable thing in the interests of the public that the surface of the carriageway should not be broken up. So much for clause 18. With regard to clause 19, the Middlesex County Council suggested that, in the interests of the Gas Company, of the County Council, and of the public, it was desirable that the Company should lay their mains, as far as possible, at the time the road was being constructed, in order to avoid ripping-up the footpaths. Again, the Gas Company did not object to this, and really, looking at clauses 18, 19, and 20 all together, it seemed that the whole grievance was how to arrange these matters. It was impossible to treat the question in the form of a chess board, and to say that in certain squares certain pipes should be laid. The facts were that the Middlesex County Council, like all other public bodies entrusted with powers, were expected to exercise common sense and to make proper provision for the laying of pipes. He also maintained that the provision of culverts at cross-roads was eminently reasonable and practicable, having in mind the reference to arbitration with regard to this, and with regard to all the other matters relating to the laying of mains. Further than this, the Council invited the Gas Company to estimate as far as possible their probable requirements for the future, so that provision could be made for these extra mains at the time the road was constructed, with the only condition that the Gas Company should pay for this extra provision, as they would have to pay for opening the roads when the actual time came for laying them.

The CHAIRMAN, after the room had been cleared, announced that the Committee had decided that clauses 18, 19, and 20 should stand part of the Bill.

The Hon. EVAN CHARTERIS submitted the following clause on behalf of the Brentford Gas Company; the object being to ensure the carrying out of the Committee's decision that there should be ample accommodation for the mains of the Gas Company:—

> (1) The Council shall provide at either side of the carriageway of the new road (Work No. 1) such space as may be necessary for the laying thereunder of such pipes and mains of the Brentford Gas Company (hereinafter in this section referred to as the "Gas Company") as may be reasonably required from time to time for the purposes of their undertaking. The space to be provided, and the position and dimensions of the pipes and mains to be laid thereunder, shall, in default of agreement, be determined as hereafter provided.
>
> (2) During and simultaneously with the construction of the new road (Work No. 1), the Gas Company may, at all the roads crossed by the said new road, lay under and across the said new road a gas-pipe of such diameter as the Gas Company shall see fit. The Gas Company shall, one month before commencing the laying of any such gas-pipe, submit a plan and section thereof to the Council for the approval of the Council; and if within one month from the receipt of such plan and section the Council have not intimated such approval to the Gas Company, a difference between the Gas Company and the Council shall be deemed to have arisen, and such difference shall, in default of agreement, be determined by arbitration as hereinafter provided. The Council shall repay to the Gas Company the costs incurred by the Gas Company in providing and laying any such gas-pipe, less the cost of providing and laying such gas-pipe of a diameter equal to that of the existing gas pipe for which the same is substituted.
>
> (3) Any difference under this section shall be referred to, and determined by, an arbitrator to be appointed, on the application of either the Council or the Gas Company, by the President of the Institution of Civil Engineers.

Continuing, Counsel said he wanted it made perfectly clear that, as the Gas Company were to be driven from the roadway on to the footway, and to be put to the cost of laying a duplicate line of pipes instead of a single line, there should be no possible doubt as to the accommodation which would be available. The clause, he said, asked for no privileges which the Company were not at present entitled to under the general law; but he wanted to prevent the possibility of the position arising that the Gas Company might ask for room to lay a 30-inch main, and the County Council saying that there was not sufficient space available. Under his clause, in the event of such a difficulty the matter would go to arbitration; and if the arbitrator declared to this effect, the County Council would be compelled to find room. The second part of the clause provided for the laying at the time of the construction of the road, at all the cross roads, a main of sufficient size to deal with the Company's possible consumption as far ahead as could be humanly foreseen. The Company, he said, preferred this to having their pipes laid in culverts, even though it might mean a considerable amount of capital expenditure which would be unremunerative for very many years. In doing so, however, the Company thought it fair that the Council should repay the cost incurred by the Company in providing this larger main in excess of that which would be necessary for laying a pipe of a diameter equal to the existing mains. This, he thought, was only fair, as the County Council would be spared the expense of constructing the subway.

Mr. WROTTESLEY, on behalf of the Middlesex County Council, said that the whole of the matters raised in this clause were covered by the Committee's decision. What was being asked now was that the Council should dedicate to the Brentford Gas Company a definite portion of the available space, irrespective of their needs in the future. This could not be done. There were other people to think of, such as the Water Board, the Postmaster-General, and the Electric Light Company; and he resisted the clause.

The CHAIRMAN said the Committee were of the opinion that, having passed clauses 18, 19, and 20, the additional clause proposed by the Gas Company could not be inserted. The Committee were of the opinion that subways met the difficulty of the cross roads best.

The remainder of the clauses were then adjusted, and the Bill was ordered to be reported for third reading.

HIGH-PRESSURE METER TESTING IN LONDON.

London County Council Clauses Passed.

It was reported in the "JOURNAL" last week, on p. 40, that the clauses relating to testing high-pressure gas-meters in the City of London (Various Powers) Bill had been passed by a House of Commons Committee, and that identical clauses would be in the London County Council (General Powers) Bill; an agreement having been come to with the Gas Companies concerned. The latter measure came before Section A of the Local Legislation Committee of the House of Commons last Wednesday; and, following the usual custom before this Committee, the clauses, although unopposed, had to be justified. With the exception of the necessary alterations making the London County Council the authority, the clauses are in identical terms to those set out in our last issue.

Mr. CLODE, K.C., for the London County Council, said the matter had arisen in this way. Prior to 1859 there was no legislation of any

sort to secure what a standard cubic foot of gas should be, and there were no means of measuring it. The Sale of Gas Act, 1859, however, established a standard; and by an extension of the laws of weights and measures to gas, provision was made that all meters should be tested and stamped. In 1860, the Sale of Gas Amendment Act was passed, and the jurisdiction under the 1859 Act was conferred on the Justices of the Peace. By the Metropolitan Gas Amendment Act, 1861, jurisdiction was transferred to the Metropolitan Board of Works, and subsequently to the London County Council. In 1864, there were comparatively few meters tested; the number being 31,000. At the present time, however, some 250,000 meters were tested every year. That this testing was a real protection to the consumer was shown by the fact that some 40,000 were rejected annually. The present tests, however, were only for low pressure. Since the tests were prescribed, there had been a remarkable development in high-pressure gas, which was used for lighting at a pressure equal to a column of water from 10 to 100 inches high, and for heating equal to a column of water 332 inches high. The tests for low-pressure gas were not nearly sufficient for high-pressure gas, because as the pressure increased the gas lost in bulk; hence a less quantity of gas was recorded as having passed the meter. With a pressure of 50 inches, the loss was 10 per cent.; with a pressure of 100 inches, 19 6 per cent.; and with a pressure of 415 inches, it was something like 50 per cent. In other words, at 415 inches pressure, 1000 cubic feet of gas would be recorded as 495 feet. In these circumstances, various expedients had been resorted to. Some people used no meter at all in connection with high-pressure gas; others used ordinary meters, and estimated the extra charge in some rule-o'-thumb way. Some consumers used ordinary meters and afterwards had the gas compressed, and others again had introduced a compensating device, whereby high-pressure gas was registered as if it were low-pressure gas. Up to the present there had been no desire on the part of anyone to evade the law; but it seemed the clear duty of the London County Council to obtain some powers for testing high-pressure meters. The clauses had now been agreed; and there was no opposition from the gas interests. Neither was there a report from any Government Department.

Mr. *James Ollis*, Chief Officer of the Public Control Department of the London County Council, said the present high-pressure gas was not contemplated by the Act of 1859; and to apply the tests under the Act to high-pressure meters was useless.

The CHAIRMAN: Where does the responsibility or interest of the London County Council come in?

Mr. CLODE said it came in in this way. High-pressure gas was being rapidly developed by the gas companies; and in order to measure it to the satisfaction of the companies and the consumers a special type of meter had been brought into use.

The CHAIRMAN: Why should the County Council take responsibility for this?

Mr. CLODE: Because the meters are brought to the Council's offices to be tested and stamped. But our officials can only apply to them the test laid down by the Act of 1859. They were bound to test under the Act of 1859; but the test was of no value when applied to high-pressure gas. The authorities had worked in conjunction with the gas companies. It was purely a technical question, and there had been no communication with the consumers.

Mr. *R. S. Hilton*, the Secretary and Manager of the Birmingham Corporation Gas Department, said he considered the clauses in the Bill to be quite reasonable. They were similar to those which the Birmingham Corporation had worked under for a few years.

The CHAIRMAN: We are looking at the matter as one which is constantly coming up, and whether the circumstances here are sufficient to justify these exceptional powers to you, or whether it should be a matter for general legislation over the whole country.

Mr. CLODE said the attention of the Board of Trade had been called to what was being done; and this point had been covered by the insertion of the clause to the following effect: "Nothing in this part of this Act shall confer any exemption from the provisions of any General Act relating to high-pressure gas-meters which may be passed in any future session of Parliament."

The Committee then allowed the clauses to go forward.

Workmen's Compensation Case at Brentford.

At the Brentford County Court, last week, His Honour Judge Scully and a Medical Assessor heard a claim (under the Workmen's Compensation Act) by Frederick Lucock, of Hanwell, against the Brentford Gas Company, in respect of an accident at Southall. Mr. Morle, in opening the applicant's case, said that he was a sfoker in the employ of the Company, and on Dec. 10, 1911, he met with an accident in the course of his employment, by which he broke his right wrist. Compensation was paid until Dec. 7, 1912; and during that time applicant was partly attending hospital and partly being massaged. Compensation was then stopped, and these proceedings were started; and on Feb. 7, 1913, applicant was offered light work. This was accepted, and he was taken back at 28s. per week, with the addition of 7s. 6d.—half the difference between his then wages and his former pay. Later it was suggested that applicant should submit to an operation; but this he declined to do on his doctor's advice. Then massage was proposed; it being held that this would get rid of the limitation of the movement of the right arm. The applicant's doctor held that the work he was doing would have this effect. Consequently, the proceedings were restored. Applicant bore out this statement in evidence, and said he was working at Southall at the time of the accident. Through a bar slipping, some coke fell; and to save himself from being burnt, he twisted quickly, fell on his side, and broke his right arm just above the wrist. The defence was that the applicant was fit to work, and that if he had undergone an operation he would have been thoroughly restored to his former condition. Medical evidence was called on both sides; and after the Medical Assessor had examined the applicant, His Honour said the Assessor was of the opinion that, while the applicant was not shamming, there was a reacting nervousness, and fear had prevented him from closing his hand. His award was, therefore, for the respondents, with costs.

MISCELLANEOUS NEWS.

COAL SMOKE ABATEMENT COMMITTEE.

Evidence on Behalf of the Gas Industry.

The Departmental Committee appointed by the Local Government Board to consider the question of smoke abatement commenced last week the hearing of evidence from representatives of the gas industry. The Committee is presided over by the Rt. Hon. RUSSELL REA, M.P.

MR. F. W. GOODENOUGH.

Mr. *F. W. Goodenough*, as Vice-Chairman of the British Commercial Gas Association, on Wednesday gave evidence on behalf of that body. He said the membership of the Association (450) includes all the leading municipal and company gas undertakings, and represents, in output, 80 per cent. of the whole industry. The work of the Association, he said, was not merely propaganda, but included scientific research. They recognized that gas undertakings of the country, having been granted special statutory powers and certain monopoly rights, had incurred obligations to the public, over and above their statutory obligations, and that it was their duty to seek every possible means whereby they could be of true service to the community while having regard to the safety and reasonable remuneration of the capital entrusted to them. These obligations were to supply gas of a suitable quality for domestic, industrial, and public lighting and heating, at as low a price as was financially possible.

Mr. H. BREVITT (Town Clerk, Wolverhampton): And the prevention of smoke at your works?

Witness: Yes; but gas companies are very rare offenders in this respect—at any rate, in the London district.

Continuing, witness said an obligation of gas undertakings was to give such facilities to the public for obtaining and making the best possible use of as great a quantity of gas as they could employ with advantage; so that the demand might be stimulated to the full, and the cost of production consequently reduced and the price to the public brought down. Finally, it was their duty to see that the gas appliances supplied were of the most economical and efficient type, skilfully installed, and carefully maintained in good working condition. Good service generally should be maintained. No gas undertaking should rest content with selling just so much gas or coke as an uninstructed public demanded. Of course, in the case of the sliding-scale, the interests of the consumers were also those of the shareholders; and maximum price companies, as they were given a monopoly right in their district, should do everything possible to stimulate the demand for gas, so that the price might be brought down to the lowest figure. The rapid growth in the use of gas for fuel in recent years, both for domestic and industrial purposes, was, among other things, due to the proved economy which had been secured directly or indirectly from the use of gaseous fuel. When gas was required for intermittent use, it was at least as cheap as, if not cheaper than, coal, taking average figures for the two commodities, and having regard to the admitted advantages of gas in the direction of greater flexibility.

The CHAIRMAN: But at what point for continuous use can gas compete with coal? We have had a witness who has given us a little evidence on this point; and he made out that, for a domestic range, with coal at 1s. 1d. per cwt. in a particular town, gas would be cheaper if it were sold at 1s. 8·12d. per 1000 cubic feet.

Witness: He has worked it out very exactly. I do not know whether he gave the calorific value of the coal used.

The CHAIRMAN: He gave us experimental values.

Witness replied that so much depended on the type of grate in which the coal was used, and whether it was employed in a fire or a kitchener. It was exceedingly difficult to give a general figure; but probably at about 1s. 6d. per 1000 cubic feet for gas, and coal at an average London price of 25s. per ton, gas would be as cheap as coal for continuous use. At the Hospital for Sick Children in Great Ormond Street, coal-fires had been used for many years. The Gas Company then installed, experimentally, gas-fires for heating one of the wards throughout the 24 hours; and it was found that, with coal at 20s. per ton and gas at 2s. 6d., the cost of gas was nearly twice that of coal. But this did not take into account any of the collateral advantages of gas—such as keeping the temperature more uniform and the absence of necessity for making-up the fires. This hospital was having a number of gas-fires installed, as the incidental advantages appealed to the authorities.

On the general question of the greater use of gas and consequent diminution of the smoke nuisance, reference was made by witness to the slot-meter as an important factor—such consumers being encouraged to use coke, instead of coal, as a means of still further reducing the quantity of smoke from domestic chimneys. The introduction of gas-heated and coke-heated boilers for hot water supply also came within this category, although the development in this direction was slow. The great and increasing growth in the use of gas for fuel purposes in every branch of industry, he added, also proved conclusively that coal gas at the prices at which it is supplied in most towns and cities of considerable size could be used in place of coal for a great variety of purposes, with advantage to the consumer, as well as to the community. An interesting example of the application of gas to industry was that of gold assayers in London, who had experimented with every other means of melting, and were steadily replacing coal with gas. The gas was supplied by the Gas Light and Coke Company at 1s. 9d. per 1000 cubic feet, under the system of discounts applying to large consumers; and the annual consumption was now 18 million feet, against 13 millions a few years ago. It was anticipated that the quantity used in this way would be 25 million feet in a very short while. This growth of the use of gas for domestic and industrial uses, with consequent diminution of the smoke nuisance, would progress with far greater rapidity (*a*) if public authorities and the Government themselves would set the example in every possible way [Witness reminded the Chairman that he was sitting next to a coal-stove in the Committee-room]; (*b*) if all property owners and architects would, as

some at present did, facilitate the use of gas cooking, warming, and water-heating appliances in all new property erected and in all old property undergoing reconstruction or renovation; (*c*) if Parliament would facilitate the substitution of a calorific for an illuminating power standard; (*d*) if all municipalities would give full facilities for introducing prepayment meters in the homes of the working classes; (*e*) if the education authorities throughout the country would take more active steps to secure the effective practical training of all gas-fitters, in co-operation with either the gas industry or the plumbers and gas-fitters, or both.

Mr. P. C. SIMMONS: Is the suggestion that there should be gas-fires in all Government offices?

Witness: The suggestion is that a smokeless fuel should be burned.

Mr. H. BREVITT: Where would smokeless fuel be obtained from—from a gas company?

Witness: Undoubtedly.

In answer to questions as to architects facilitating the use of gas in their designs, witness said there was a growing inclination to provide the necessary apparatus on the part of owners and architects; but architects were very slow to wake up to the fact that the public required gas for cooking, &c. It was seldom that an architect laid out a house so that gas heating and cooking could be applied easily. He regarded the calorific test as very important. The change of test would result in a reduction in the cost of manufacture, and consequently in the price to the consumer. The change of standard would materially reduce the cost in some cases, and slightly in others. It would slightly reduce the cost in the case of the Gas Light and Coke Company, but still sufficiently to make it worth while to the consumer. Regarding (*d*), some municipalities who owned electricity undertakings placed obstructions in the way of the use of gas in their own workmen's houses. East Ham was a case in point. The reason why he advocated more practical training in gas-fitting was that by this means heating and cooking apparatus would be more efficiently installed; and if the Committee could call attention in their report to the desirability for further co-operation, they would be doing a public service.

The CHAIRMAN: I suppose it is true to say that oil is the poor man's light?

Witness: No, except in country districts. It is not used by the working classes in towns, where gas is available. I should think it would be more correct to say that in all towns and cities gas is the working man's light.

Continuing his evidence, witness gave figures from returns from 206 undertakings, which showed that in the ten years ended Dec. 31, 1913, the number of consumers increased from 3,368,000 to 5,056,000. The prepayment meter consumers now slightly exceed the number of ordinary consumers. Reverting to the question of providing facilities for the greater use of gas in new premises, it was suggested that local authorities might well insist, in their building by-laws, upon provision of space for a gas-cooker and a gas-copper, if not of the appliances themselves, as part of the necessary fixtures. In many parts of America, where they have great regard for smoke prevention, gas cooking-stoves formed part of the necessary equipment of all tenements, and were provided by landlords as a matter of course. In old premises he had frequently taken out the kitchen range, tiled-in the space, and fitted a gas-cooker and coke-boiler.

Professor COHEN: I can support that from personal experience.

Witness said that Dr. de Vœux, the President of the Coal Smoke Abatement Society, had also done this with very satisfactory results.

Professor COHEN: But it is more expensive than coal.

Witness remarked that it all depended upon the price of coal and the domestic arrangements—for instance, whether it permitted of one servant being dispensed with. Continuing, he mentioned that Messrs. Lyons, the caterers, paid a £17,000 gas bill for cooking alone, the Aërated Bread Company £14,000, and the British Tea Table Company £5000. Gas-fires were now becoming much more artistic in design, and architects were steadily becoming advocates of gas. One of the drawbacks to the proper installation of gas-fires was the employment of ironmongers' gas-fitters, who did not know how to deal with a chimney which had a down-draught, and frequently allowed the products of combustion to be blown back into the room. This often resulted in a retardation of the progress of the gas-fire, as it created dissatisfaction. It was in this direction that the Gas Light and Coke Company's education scheme for fitters was doing good work. As to suggestions for the use of smokeless fuel, public authorities could set a very good example by ceasing to use smoke-producing fuel.

The CHAIRMAN: Do you mean you would use compulsion?

Witness: I should like to see compulsion as a member of the public, and not as a representative of the gas industry, where, as I believe, the compulsion would be to the advantage of the consumer. But "compulsion" is not a word that is very popular in this country.

Mr. BREVITT: I suppose you get smoky chimneys at gas-works?

Witness: Very occasionally. At a gas-works, the fuel that is used for heating the retorts is smokeless fuel.

Do you mean to say that of all the gas-works you know there is no case of smoke?—Not as a matter of general occurrence.

But there are instances?—I will not say there are not instances; but it is not a general occurrence by any means.

Bailie SMITH referred to carbon monoxide from gas-fires, and said that in the Glasgow experiments a few years ago a trace of carbon monoxide was found.

Witness replied that the "Lancet" experiments showed there was none.

Professor COHEN said he had carried out some tests, and did not get any.

Bailie SMITH mentioned that the Glasgow Corporation some years ago issued instructions to every department that they must use some form of smokeless fuel, leaving it to the department to select its own particular fuel.

Witness replied that Glasgow had done more than any other local authority in this direction.

Professor COHEN suggested that the weak point of gas-fires was ventilation, and that something should be said with regard to this.

Witness could not agree that ventilation with gas-fires was inadequate. It was steadier and quieter than with a coal-fire; but various tests had shown that a gas-fire had a ventilating effect of 4000 cubic feet per hour.

Professor COHEN: That is not the experience of other people. It is very small indeed.

Witness said it was not only the quantity of air carried through the flue that should be taken into account, but the induced draught in the chimney.

Professor COHEN added that he did not think the ventilation difficulty was a very serious objection, as he believed it could be got over.

Mr. H. O. STUTCHBURY thought that a Registered Gas-Fitters' Bill, on the lines of the Registered Plumbers' Bill, might get over the difficulty of bad workmanship.

Witness said he thought this required very careful consideration. With regard to limiting to cost price the charge for gas in the case of municipalities, there were differences of opinion among the members of the Association. He did not think it would be fair to the Association to give his personal opinion.

MR. D. MILNE WATSON.

Mr. *D. Milne Watson*, General Manager of the Gas Light and Coke Company, on Thursday gave evidence in that capacity, and also as Chairman of the London Coke Committee. He recapitulated the steps which the Company have taken for many years to mitigate the smoke evil, by giving facilities for the increased use of gas through the hire-purchase system, and generally. Particulars were also given of the Company's system of training boys as gas-fitters; the object being to produce a better type of fitter. In this aim, witness said, the Company have largely succeeded. One of the worst enemies of gas companies, he added, was the old-fashioned extravagant gas-stoves; but these were being rapidly replaced by the more modern types. Another factor in the increased use of gas was the reduction in price that had taken place; it having come down from 3s. to 2s. 6d. per 1000 cubic feet in recent years. Details of the Company's sliding-scale were given, and the recently-granted calorific standard of testing was explained.

The CHAIRMAN: What is the use of the maximum?

Witness: We do not see much use in it ourselves.

Do you think the test will enable you to reduce the price?—I am afraid it will not do so at once, because the standard which has been put upon us means that the gas will have to be made of the same quality as before. We had hoped to get a rather lower standard.

Answering further questions, witness said that, although the Company had been able to effect a saving of 2s. per ton in their recent contracts, coal was still at a very high price. Simultaneously with this decrease of 2s., the price of residuals had fallen. Unless the price of coal went down further, it was difficult to see how the price of gas could be reduced. There was a greater difference between the price of coal and coke to-day than there had been for twenty years. Both coke and sulphate of ammonia, the two chief residuals, stood at a very low price. As to the scope for the future, middle-class houses were well supplied with gas apparatus; but there was a larger margin for development in the working-class houses for cookers, gas-coppers, and water-heating apparatus, and a still larger one in the better-class houses, where it was difficult to get advertising literature before the householder. The figures for the Company's area showed about one gas-fire per house; so that there was considerable room for development. Industrially, gas was used more for small applications—at any rate, in London—although there were several thousand gas-engines connected to his Company's mains. In other directions, the Company had experts who designed furnaces, &c., for certain classes of work where the manufacturers did not seem to think gas could be applied. The Company had a laboratory in which such experiments could be carried out. Similarly with gas-engines, the Company employed experts to give advice to users. With regard to gas-fires, there were still people who required to be convinced that they were not unhealthy. It was a fact, however, that they were quite as healthy as coal-fires; and the ventilation was every bit as good.

Professor COHEN: Have you tested the ventilation, because that is a serious question?

Witness: Experiments have been carried out by a great number of experts; and I daresay you have had figures given to you already.

No; I am afraid we have not had any figures yet?—There is a pamphlet by Dr. Leonard Hill, entitled "Health Value of Radiant Heat," which gives considerable information. Continuing on this question, witness said the gas industry had considerable support from the medical profession. Some 3000 doctors used gas-fires in their premises; and his Company had fixed 6000 fires in all for the medical profession.

The CHAIRMAN: That is a very considerable proportion. You have taken the trouble to get the figures out carefully?

Witness: Oh, yes; they are accurate figures from our own records. He next referred to the lady cookery demonstrators of the Company, who gave 7000 demonstrations (mainly in private houses) during the half year ended Dec. 31 last, and have given 80,000 in all in the Company's district since the system was inaugurated. Reference was also made to the fact, as emphasizing the increasing use of gas for cooking purposes among the working classes, that the periods of greatest demand in the summer time are during the breakfast time and between 11 a.m. and 1 p.m. on Sundays, when the dinner is being cooked. The same remark applied to the Brentford Company's area. Passing on, he spoke as the Chairman of the London Coke Committee—a body formed twelve months ago by nine gas companies, with the object of demonstrating to coal users the economies and advantages of the use of coke. An expert is employed, who visits various users of coal, and users to the extent of 50,000 tons per annum have been persuaded to use coke instead. The Company's steamer which brings coal from the Tyne, and also the steamer belonging to the Wandsworth Gas Company, had been, with very little modification to the furnaces, and with economical results, changed over to use coke. It had been necessary with one of the steamers to increase the draught; and modifications of this description were necessary in each particular case according to the needs. But it was quite practicable.

The CHAIRMAN: I suppose the result will be that, as soon as you get a sufficient number of consumers of coke, the price will be increased, and therefore your argument as to cheapness would be destroyed?

Witness: Not necessarily. We desire to get a price that will enable us to do business. We only want to get a fair price, and not a higher price than that. We sold 450,000 tons of coke last year, and we have 100,000 tons in stock; so that there is plenty in hand.

In the course of further answers, witness referred to the "London" coke-boiler designed for giving hot water at a cost of 4d. per day with coke at present prices. It was the cheapest form known of getting hot water. The Coke Committee had also been experimenting with special domestic stoves for burning coke. He did not think London lent itself to the supply of a cheap form of power gas—first, on account of the difficulty of laying the necessary mains; and, secondly, because there was not a sufficiently industrial area around any of the Company's works. Neither did he think the supply of forms of fuel such as coalite could be made a financial success. The Gas Light and Coke Company some years ago supplied a similar fuel, known as "Carbo," but had to give up selling it, owing to the cost of manufacture. No further experiments had been carried out by the Company in the direction of obtaining a special smokeless fuel.

Colonel HUGHES: Would you suggest to the Committee that they should recommend some stringent law prohibiting the use of the open coal-grate?

Witness: As long as they did not make smoke, that would be sufficient. But if the coal-fire must produce smoke, then I think the law might very well interfere with the unrestricted use of coal.

The average house to-day is bound to produce smoke?—I think so. The case against the open fire is a very strong one, especially when you have alternatives.

The question is whether these alternatives are real alternatives. How about the question of cost?—We calculate that a dinner can be cooked for 3d., and a supply of hot water given continuously to a house with two bathrooms, for 4d. or 5d. a day, by coke.

Do you think the time is ripe for active pressure to be brought upon domestic consumers to compel them to use the alternatives?—Yes; I think it is quite ripe, because gas-fires are almost as good as they can be.

The Committee then adjourned until July 22.

THE LATE MR. CHAMBERLAIN AND THE BIRMINGHAM GAS UNDERTAKING.

Eulogy by the Chairman of the Gas Committee.

At a Special Meeting held by the Gas Committee of the Birmingham Corporation last Thursday, reference was made to the connection of the late Mr. Joseph Chamberlain with the gas undertaking.

Sir HALLEWELL ROGERS (the Chairman of the Committee) said that, considering the keen interest Mr. Chamberlain took in the municipalization of the gas supply of the city by the acquisition of the two Gas Companies during his mayoralty, it was only right and fitting that they should place on their minutes a record of their deep regret at his death, and an appreciation of what he had done for the department. As they knew, the purchase of the Gas Companies—then unparalleled in the history of provincial undertakings—was very successfully engineered through Parliament; and Mr. Chamberlain, with infinite tact and resource, brought the whole matter to a successful conclusion. He was especially desirous that, this being a large commercial undertaking owned by the Municipality, its finances should be managed by the department itself; and it was largely due to the sound basis on which the department was placed at the first that the Gas Committee had since been able to contribute more than £2,000,000 sterling towards the rates and in aid of public lighting, and reduce the capital by upwards of £1,000,000. The average price per 1000 cubic feet of gas at the present time was just about half what it was in the year 1875, when the undertakings were acquired; and the output since that date had increased by more than 300 per cent. Mr. Chamberlain took the chairmanship of the Gas Committee, and gave the most minute attention to every detail. That his work for the Council was well appreciated was shown by the amendment which was moved to the adoption of the first yearly statement of accounts, which was as follows: "That the report of the Gas Committee be approved, and that, considering the manner in which the business of gas supply has been acquired and conducted, whereby in less than two years upwards of £60,000 has been obtained for the work of the borough and the benefit of the inhabitants, while at the same time the price of gas has been reduced and its quality improved, the Council hereby records its thanks to the Chairman and members of the Gas Committee for the eminent services they have rendered to the town." On Aug. 3, 1880, the Gas Committee reported the resignation of their Chairman, on his accepting office as President of the Board of Trade. With the knowledge that Mr. Chamberlain was so intimately connected with all that went to make the sound foundations on which the Gas Department rested at the present time, it was fitting that they, as a Committee, should take the opportunity of expressing their sense of the personal and general loss they have sustained, and he moved: "That the Gas Committee place on record their deep regret on the death of the Right Hon. Joseph Chamberlain, M.P. They recall with feelings of pride and admiration the fact that it was due to his initiative that the Birmingham gas undertaking was acquired by the Municipality in the year 1875, and that he was the first Chairman of the Gas Committee, which important office he held until 1879. During that period he formulated a policy to be pursued in conducting the business of the Gas Department which has since been largely followed by successive Gas Committees with gratifying results."

Alderman LLOYD seconded the motion; and it was at once carried unanimously.

Personal Injuries by a Gas Explosion.—The curate of St. John's, Little Horton Lane, Bradford, on moving into a new house, detected a smell of gas, and searched for the escape with a light. He was burnt about the face, and his right hand was somewhat badly injured.

CARLISLE CORPORATION GAS UNDERTAKING.

The Annual Accounts.

In his annual report, the City Treasurer of Carlisle states that the expenditure on the gas-works on capital account for the year ended March 31 was £1220, of which £346 was for meters for new consumers, £274 for lamps (chiefly in the districts added to the city in November, 1912), and £599 for mains. Of the last-named amount, £377 was expended outside the city for the gas supply at Kingstown and Scotby, and £221 within the city. This expenditure has exceeded the amount available for extensions by £1100; and it will therefore be necessary for an application to be made for further borrowing powers.

The gross profit for the year, as shown by the revenue account, is £7791, a reduction of £5056 as compared with last year. The reduction in the charges for gas which came into operation on Jan. 1 (3d. per 1000 cubic feet being taken off the price to ordinary meter consumers, and 6d. off the charge to prepayment meter users) had reduced the total amount of gas-rental by £1470. The items of expenditure under the heading "Manufacture of Gas" show an increase of £2629, due largely to a higher price having to be paid for coal; and the items under "Distribution of gas" are £437 higher. The cost of maintenance, &c., of public lamps is £728 more, probably accounted for by the further adoption of automatic apparatus for lighting and extinguishing. The assessment for rating purposes of the works and pipes having been increased from £3198 to £6103, the amount paid as rates has gone up from £1214 to £2356. Payments of income-tax, instalment of loans, and interest, amount to £4217; and the balance of net profit available is £3589.

SOUTHPORT GAS ESTATE.

Annual Report.

In his annual report for the year ending March 31, which came before the Council at the July meeting, Mr. Bond stated that there had been an increase in the consumption of gas amounting to 8,337,000 cubic feet, being 1·51 per cent. above last year's figures. The increase was less than anticipated, owing to the temperature of the atmosphere being higher than usual during the winter months. The increase was chiefly due to the large number of gas-fires let out on the hire purchase and simple-hire systems. The prepayment system of gas supply now amounted to 15·63 per cent. of the whole consumption, and showed an increase of 13·12 per cent. above last year. Of the total gas supplied through ordinary meters, the Southport consumption was 332,360,200 cubic feet, or 79·07 per cent.; the Birkdale consumption, 73,202,000 cubic feet, or 17·42 per cent.; the Ainsdale consumption, 12,293,800 cubic feet, or 2·92 per cent. The remaining 2,435,700 cubic feet, 0·59 per cent. of the total, was consumed in the Banks and Scarisbrick district.

The average price received for all gas supplied amounted to 2s. 5·15d. per 1000 cubic feet. This was 1·21d. per 1000 cubic feet less than last year. On account of the reduction made in the price of gas, the income was approximately £2800 less; but he had no doubt this reduction in receipts would in the near future be made up by increased sales. The gross profit for the year amounted to £27,702; and after paying £13,683 towards interest and sinking fund, there remained a net profit of £14,019, which it was proposed should go to the relief of the rates, less £19 to be carried forward. He pointed out that the cost of gas manufacture had increased considerably, mainly due to the great advance in the price of coal and the decrease in the returns from residual products.

In reference to vertical retorts, Mr. Bond wrote: "The Glover-West vertical retort installation was started at the end of October, since which date numerous experiments have been made of the grading of the various classes of slack which are now being delivered at these works. These experiments have been made with a view of reducing the cost of manufacture; and so far the results have turned out satisfactorily. . . . The telpher plant which conveys the coke from the vertical retorts to the boilers, hoppers, and carburetted water-gas plant has worked satisfactorily since the time it was first installed." The total quantity of gas sold during the year was: Southport, 436,503,500 cubic feet; Birkdale, 99,260,300 feet; Ainsdale, 16,853,000 feet; Banks, 2,526,500 feet; and Scarisbrick, 2,578,100 feet. The number of gas-cookers in use at the end of the year was 9302, against 8945 for the preceding year; and the number of new cookers fixed was 449 on hire and 36 on hire-purchase. The gas-fires fixed numbered 1372—sold, 415; hire-purchase, 108; simple hire, 849. The total number of public lamps in the district of supply at the end of the year was 2762; the Southport, Birkdale, and Ainsdale lamps being lighted 3045 hours in the twelve months.

WORKINGTON CORPORATION GAS UNDERTAKING.

Application to Borrow £25,000.

An inquiry was held at Workington on Friday, by Mr. R. R. HOOPER, Local Government Board Inspector, into an application to borrow £25,000 for improvements at the gas-works.

The TOWN CLERK said the net liabilities on gas-works capital account, after deducting the amount accrued in the sinking fund, was £17,500. The price of the gas was lower than in any other town in the kingdom, having regard to population and rateable value. The £25,000 was required for a retort-house, carbonizing plant, and machinery, as per the tender of the Woodall-Duckham Vertical Retort and Oven Construction Company, £17,166; and rotary washer, station-meter, motor-house, mains for gas, water, and steam, tar dehydrating plant, fencing, siding, boundary wall, power-house, weighing machine, testing, &c., as per the Engineer's estimate of £3500. It was proposed to erect the buildings on land the Corporation already possessed for gas

purposes. The loans of 1878, amounting to £26,500, had been redeemed out of profits; and the interest and sinking fund charges for money borrowed since had been similarly met. At the time of the incorporation in 1888, the gas-works were valued at £75,000. In 21 years, the demand for gas had increased by 130 per cent.; and this year it was expected to reach 130 million cubic feet. For lighting, the charge was 2s. per 1000 cubic feet, and for power 1s. 9d.

The Borough Treasurer said the loans outstanding totalled £187,311, of which £113,135 was productive. The only overdraft on capital was £7993 for gas purposes. Sanction for £7500 was applied for in January, and held over pending the Royal assent to the Provisional Order.

The Mayor (Mr. R. E. Highton, J.P.) pointed out that the surrounding villages would have to come to them for gas, as no one else could supply it so cheaply. The cost of coal and wages had gone up something like 40 per cent., and if they were to continue to supply gas at a reasonable price, they must have the best plant.

ROYAL SANITARY INSTITUTE CONGRESS.

In the Engineers' and Surveyors' Section at the Royal Sanitary Institute Congress at Blackpool last Tuesday, the chair was occupied by Mr. J. S. Brodie, the Borough Engineer and Surveyor of Blackpool, who, in the course of his opening address, reviewed the chief matters of interest to municipal engineers and surveyors which had occurred during the year.

In the domain of public water supplies, he said, the new scheme for an additional supply of 500 million gallons a day for the City of New York from the Catskill Mountains, a distance of 135 miles, at a cost of 35 millions of pounds sterling, easily creates a world record. This supply, which takes three days to flow from the impounding reservoir in the Catskills, will be delivered at New York under a pressure of nearly 600 feet, and will rise up to the eighteenth storey of New York's sky-scrapers, without pumping.

In the British Islands, the question as to dealing with public water supplies as a whole, instead of each community rushing to be first in the field to secure its own particular requirements, is coming more and more to the front; and it is to be hoped that before very long public opinion will move more quickly towards legislation in this direction. A novel suggestion was made in a recent memoir of the Geological Survey staff, to the effect that deep wells from which water is pumped might be artificially replenished by rain-water falling on impervious surfaces being drained into dumb wells sunk through the impervious stratification into the water-bearing strata below, and from which the pumped water supplies were obtained.

A point of much importance to public water authorities is the comparatively short-period loans allowed by the Local Government Board for reservoir construction. The only way to overcome this is by the increasing use of reinforced concrete construction, by which the first cost of the work is so much reduced that there is no extra burden in meeting repayment of loans for the shorter period; and there is the further great advantage of the loan being repaid altogether in much shorter time.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The extensions at the Dunoon Gas-Works have been got into working order, and the vertical retorts (erected by West's Gas Improvement Company) are now making gas. The cost of the buildings and machinery has been about £10,000. In addition to this there has been provided a coal-shed, roof, boundary wall with new entrance gate, a washer, scrubber, and station-meter, and a gasholder, on the spiral-guided system, of 250,000 cubic feet capacity.

The Macduff Town Council have decided to substitute certain oil-lamps by up-to-date gas-lamps, and arrangements were made for a joint meeting of the Banff and Macduff Town Council Lighting Committees for the consideration of the question of a joint scheme of electric lighting for the two burghs. In view of this meeting, it would appear a sound proposition that the two Gas Companies concerned should combine their efforts to show that gas is a better and cheaper illuminant and heat agent than electricity at any figure at which it could be supplied in that district. Probably the best scheme would be the amalgamation of the two Companies, so that every possible economy could be procured and the price of gas reduced in both places.

The electric lighting scheme at Lossiemouth, which is to cost about £5500, has now been started, and connections have been made to about seventy private houses and shops. The street lamps are of the metallic filament type of 50-candle power. An electric lighting scheme has been laid before the Buckie Town Council.

The Annan Gas Company's report shows a disposable balance at the credit of profit and loss account of £1018, out of which the Directors recommend a dividend of 7 per cent., free of income-tax, and £250 is to be added to the contingent and insurance fund, which already stands at £2550. This will leave £138 to be carried forward. The increase in gas sold has been over half-a-million cubic feet.

There have been a number of dividends declared by gas undertakings. At Duns 12½ per cent. has been paid, and the price of gas reduced from 5s. to 4s. 7d. per 1000 cubic feet. At Kinross and Milnathort, 10 per cent. is to be paid. A bonus could also have been added, owing to an increase in the consumption of about a million cubic feet; but, in view of the probable transfer to the Council, this has not been done. Pitlochry, Coupar Angus, and Blairgowrie have each declared dividends of 5 per cent. Cupar pays 6¾ per cent., and places £400 to depreciation. At Perth they have wiped off last year's debt and have

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* * *

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* * *

See Official Report, "LANCET," 11th July.

* * *

This unique scientific testimony from a journal which is entirely impartial vindicates our principles of gas-fire construction. All these 12 fires have their canopies in our standard position well above radiants, preventing loss of radiant heat by cold updraught over radiants.

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now a balance of £350; and the Committee have decided to put a larger sum to the depreciation of the stoves. The Castle-Douglas Gas Company are paying 7 per cent. dividend and a bonus of 3 per cent. on the capital stock. They are also reducing the price of gas from 3s. 6½d. to 3s. 4d. The Bellshill Gas Company, Limited, have held their twelfth annual meeting and declared a dividend of 10 per cent., free of income-tax. The gas made was 42,228,000 cubic feet for the year—an increase of 3,126,000 cubic feet over last year, or more than 7 per cent. The price is to be reduced to 2s. 9d. At the meeting of the Leslie Gaslight Company, it was agreed to double the share capital.

The Gas Committee of the Dunfermline Town Council are to recommend to the Council that the salary of Mr. Alexander Waddell, the Gas Engineer and Manager, shall be increased by £100 per annum. Mr. Waddell has been carrying out a number of schemes for lighting the outlying districts, and has made many extensions at the works, including a vertical-retort installation of his own design.

The Gas Committee of the Kilmarnock Town Council have made contracts for 13,650 tons of coal at an average price of 11s. 4d. per ton, as against 12s. 10d. for last year, or 1s. 6d. per ton less. The Provost thought they might congratulate themselves on having made favourable bargains. Compared with some of the larger municipalities during the tremendous rise in the price of coal, he thought Kilmarnock was to be very much congratulated. They had kept the price of gas at the very low figure of 2s. 3d. per 1000 cubic feet—and this constantly for the last three years—had paid £2250 more for coal last year, a considerable amount for increase of wages, and yet were able to finish the year with a credit balance. They were not able at once to announce a decrease in the price of gas; but it was quite on the cards that they might do so during the progress of the present financial year.

At the meeting of the Motherwell Town Council, it was reported that the money for the gas-works, which the Arbiter had fixed at £141,874, had now been paid. The Council were therefore in possession of the works as from May 31 last. The Clerk also reported that he had since been served with an action, at the instance of the Carfin, Cleland, and District Gas Company, in which the Company asked the Court to find that the Council were not entitled to exercise the powers conferred on burghs under the Burghs Gas (Scotland) Act until such time as they had given notice to their Company that the Council were willing to negotiate with them for the purchase of their undertaking, and asking interdict until the procedure had been taken. The area supplied by this Company within the burgh of Motherwell is a very small one, and the works are situated entirely in the county area.

In reply to an inquiry at the Glasgow Town Council, Bailie Irwin, the Convener of the Gas Committee, stated that they had this year received offers of 2,249,500 tons of coal, against 1,573,000 tons last year. The average price at which the 763,000 tons have been purchased this year is 11s. 5·85d.; while the 789,500 tons bought last year came to an average of 13s. 3·15d.—a difference of 1s. 9·3d. per ton, or a total decreased cost of about £60,000. Questioned as to a reduction in the price of gas, Bailie Irwin pointed out that there was a heavy loss in the receipts from residuals, which would swallow up the saving on the cost of coal.

The Sub-Committee of the County Council who have the lighting scheme for the Polmont, Redding, and Rumford special lighting districts have had before them two proposals—one from the Scottish Midlands Electricity Supply Company at a cost of £2 5s. per lamp for electric light, and the other from the Polmont Gas Company to supply gas at £1 1s. per lamp per annum. The latter offer has been accepted.

Glossop Gas Company's Claim for Tar.

At the Manchster Assizes last Tuesday, before Mr. Justice Lush and a Special Jury, an action in which the Glossop Gas Company claimed £406 7s. 4d., the price of tar alleged to have been sold and delivered to the defendants, the Burnden Tar Company (Bolton), Limited, was mentioned. Mr. Wingate Saul, for the plaintiffs, said he was informed that the defendants did not appear. In their sworn answers to questions, they admitted receiving the tar, and that it was not paid for. His Lordship directed the Jury to formally find a verdict in favour of the plaintiffs.

Electric Light Failure at Bray.—The failure of the electric lighting system in Bray (co. Wicklow), attributed to shortness of water power owing to dry weather, recently left the town in darkness for about an hour. Shopkeepers dependent on their supply from the works had to requisition candles and lamps, and in places of amusement performances had to be suspended.

Clitheroe Gas-Works Results.—In his annual report, Mr. Robert Barrett, the Manager of the Clitheroe gas undertaking, states that the gross revenue for the past year was £13,784, and the gross expenditure (excluding annuities, interest, and sinking fund) £9643. Thus there is a gross profit of £4321—a decrease of £1341. The net profit is £2315; a sum of £1000 being transferred from it to the relief of the rates. During the year the quantity of gas manufactured was 82,602,800 cubic feet. The price was reduced 2d. per 1000 feet.

A Fatal Electric Current.—A report has been published that five workmen were killed, and two seriously injured, last Sunday week, at Bornim, near Potsdam, through contact with a live electric wire. One of the wires, said "The Times" correspondent, carrying electric power from the Spandau station to Bornim, snapped, and both its ends fell to the ground. A group of workmen hurried up on hearing the noise, and were standing round looking at the broken wire when one of them proposed that they should "amuse themselves with electric shocks." Ten of the men then joined hands, and one of them seized an end of the broken wire. The wire came in contact with one of the live wires overhead, and all ten men received a violent shock, and fell to the ground. Five of them were killed on the spot.

"Kent" Cooker on adjustable stand.

MODERN HOUSING.

GAS Undertakings have to cater for an ever-increasing number of dwellers in flats and small houses. These require compact cookers which have been specially designed, such as Main's "Kent" and "Sussex."

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *July* 13.

The market for tar products is steady, and the improvement noted in pitch is maintained. Buyers are raising their limits, while makers are firm at 36s. 6d. net per ton. When the pitch shipping season re-opens, there will not be much pitch obtainable in consequence of tar being required for the roads. The prices of other tar products remain at last week's figures.

Business has been done in sulphate of ammonia at £10 12s. 6d. for July-August, and at £11 for the spring, both for net cash, in buyers' bags and at makers' works, for the 25 per cent. quality. The value will undoubtedly go higher; it being clear that during the past half year there has been no increase in the make of sulphate of ammonia in Great Britain.

Tar and Tar Products in the Provinces.

July 13.

The average values during the week were: Tar, 24s. 6d. to 28s. 6d. Pitch, east coast, 33s. to 33s. 6d.; west coast, Manchester, 31s. 6d. to 32s. 6d.; Liverpool, 32s. 6d. to 33s. 6d.; Clyde, 32s. 6d. to 33s. 6d. Benzol, 90 per cent., naked, North, 8½d. to 9d.; 50-90 per cent., naked, North, 10d. to 10½d. Toluol, naked, North, 10d. to 10½d. Crude naphtha, in bulk, North, 4¼d. to 4½d. Solvent naphtha, naked, North, 9¼d. to 9½d. f.o.b. Heavy naphtha, naked, North, 9d. to 9½d. f.o.b. Creosote, in bulk, North, 3¼d. to 3⅝d. Heavy oils, in bulk, 3⅝d. to 4⅛d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 1d. to 1s. 2d. Naphthalene, £4 10s. to £10; salts, 55s. to 60s., bags included. Anthracene, "A" quality, 1½d. to 1¾d.; "B" quality, nominally, ¾d. per unit, packages included and delivered.

Sulphate of Ammonia Prices in the Provinces.

LIVERPOOL, *July* 11.

The tone of the market has again been very firm during the past week. Not only has there been the purchasing to cover previous contracts, but there have also been large orders direct from Japan and the United States. The quotations are now £10 18s. 9d. to £11 per ton f.o.b. Hull, £11 to £11 1s. 3d. per ton f.o.b. Liverpool, and £11 2s. 6d. per ton f.o.b. Leith. In the forward position there has also been good inquiry; and it is reported that £11 7s. 6d. per ton f.o.b. at the ports has been paid to manufacturers for September-April delivery in equal monthly quantities.

Nitrate of Soda.

The market for this article continues quietly steady at 9s. 10½d. per cwt. for ordinary quality, and 10s. 1½d. for refined, on spot.

From another source it is reported that better prices have been paid for sulphate of ammonia during the past week; but the value here appears to be much higher than abroad. No doubt there is some speculation going on in view of the big drop which was experienced a short time back. Hull is quoted at £10 13s. 9d. to £10 15s.; Leith, £10 17s. 6d.; Liverpool, £10 16s. 3d. to £10 17s. 6d.; Middlesbrough, £10 15s.

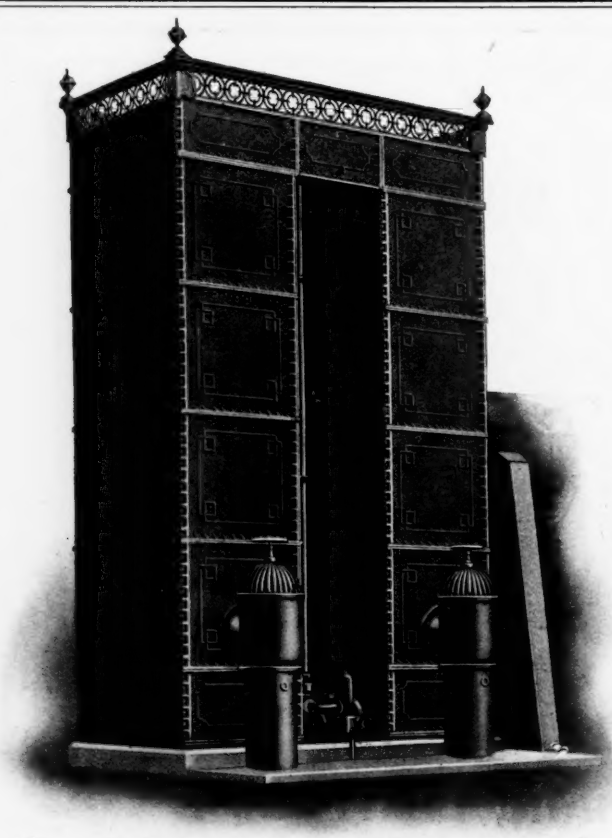
COAL TRADE REPORT.

Northern Coal Trade.

There is a good demand for all classes of coal, except household. The prices are generally well maintained; while the possibility of labour troubles in the Scottish coal trade stiffens the quotations here. In steam coals, best Northumbrians are firm at 14s. 9d. to 15s. per ton f.o.b., according to time of delivery; second-class steams are about 12s. per ton; and steam smalls are 8s. to 9s. per ton f.o.b. Best steams are very scarce for early delivery. In the gas coal trade, the lack of ready steamers is checking advances; but prices are firm. Best Durham gas coals are now from 13s. to 13s. 3d. per ton f.o.b.; for second-class kinds about 12s. 1½d. per ton is the current quotation; and for "Wear specials" 13s. 6d. per ton f.o.b. is generally asked. Among the few contracts that are reported concluded is one for about 10,000 tons of best Durhams, delivered over the next two months. Other contracts are slow in negotiating; but the Scottish possibilities may assist towards the settlement of some of the contracts. In the meantime, the deliveries are expected to improve; the demand showing the improvement usual at this season. Coke is steady. Gas coke is rather firmer, with the price of good gas coke varying from 12s. 3d. to 13s. per ton f.o.b. in the Tyne.

Reduction in Price at Newcastle (Staffs.).—The Newcastle-under-Lyme Town Council have approved a recommendation of the Gas Committee that from April 1 the price of gas be reduced to the following rates: Ordinary consumers, 2s. 6d. per 1000 cubic feet net; slot-meter consumers, 2s. 10d. and 3s. Mr. Trotter, in moving the confirmation of the minutes, said he was pleased the gas consumers had at last been considered. The proposed reduction amounts to 2d. per 1000 cubic feet.

Pilfering Coke at Birkenhead.—Curious facts were related at the Birkenhead Police Court, when two women living near the gas-works were charged with stealing a quantity of coke belonging to Messrs. Millett and Co. It was stated that, armed with rakes, brooms, and shovels, a horde of women and children wait daily outside the gates of the gas-works; and as soon as a cart containing coke passes into the street, the mob rush after it. While some knock off lumps of the fuel, others climb on to the back of the vehicle and push the coke into the street. This kind of theft has, it appears, been carried on for years. Fines of 5s. were imposed in the two cases before the Court.



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Duties of a Borough Engineer.

The Salford Borough Council will shortly appoint a new Borough Engineer; and in moving the adoption of the schedule of duties submitted to the Council by the Finance Committee, Mr. Mather said the difficulty had not been in the actual drafting of the duties, but in avoiding friction with other Committees and the heads of the various departments. It was quite conceivable that the head of a department might be better qualified to look after his own department than the Borough Engineer. Alderman Jackson remarked that the scheme seemed to suggest that some of the most important departments would be left out of the control of the new Engineer. Alderman Snape said he would not vote for the Borough Engineer being allowed to go into the gas-works and interfere with the work of the Gas Engineer. But when it came to the Gas Department taking up streets and laying mains, then the Borough Engineer ought to be consulted. Alderman Huddart argued that if they were going to have an engineer at all at the price they proposed to pay (£900 per annum), they must give him sole control. It was time they had a single "master mind," and this "master mind" must be the sole authority. Mr. Steele said the feeling of the Council was that the Borough Engineer ought to have complete control. The following amendment was eventually carried: "That the report be referred back, with instructions to amend the same in the direction of strengthening the Borough Engineer's position by making him, as far as possible, the authority through whom the various Committees shall exercise the functions appropriate to their position."

Boston Gas Company.—Satisfactory financial results were reported at the annual meeting of the Boston Gaslight and Coke Company, held last Thursday under the chairmanship of Mr. W. Pooles. The net profits for the year amounted to £3433; and the balance standing to the credit of profit and loss account, after payment of the interim dividend in February last, totalled £9003. From this the payment was recommended of the maximum dividend on both classes of shares, absorbing £1289, and leaving a balance to be carried forward of £7714. It was announced by the Chairman that it was intended in November to reduce the price of gas from 2s. 11d. to 2s. 9d. per 1000 cubic feet.

Belfast Gas Prices.—The Belfast and Ulster Licensed Vintners' Association have expressed their thanks to the Gas Committee for the recently-announced reduction in gas prices; adding their hope that it may not be long before the Committee find themselves able to follow the lead of Widnes in supplying the cheapest gas in the kingdom. Mention was also made of the efforts of Mr. Matthew M'Cusker (a member of the Association), who, while a Town Councillor, impressed upon the Committee the necessity for cheaper gas, and for giving concessions to the consumers, instead of devoting profits to the relief of the rates—especially as such relief was shared by people living outside the city boundary and burning no city gas, and by large firms obtaining their light from other sources.

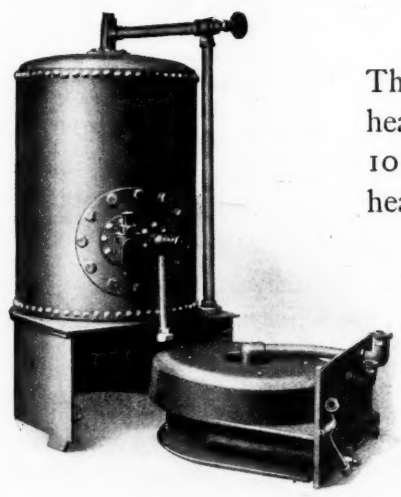
Coleraine Lighting Scheme.

The relative advantages of gas and electricity have lately been exercising the minds of the members of the Coleraine Urban District Council; and last week, after considering two reports on the subject, the matter was adjourned for further consideration at a special meeting. In one report, Mr. S. B. Langlands, of Glasgow (formerly Gas Manager at Coleraine), suggested that something in the nature of a plebiscite be taken to find out the number of persons who would use electricity, if it were available. If the result showed a sufficient desire for electricity, then he would advise that the gas and electrical undertakings should be in close proximity to each other, and administrative charges shared. A careful survey of available returns for towns of the size of Coleraine showed that at least £7000 would be needed; and it might be safely taken that £1000 per 1000 inhabitants was a good basis figure for small communities. He noted that proposals were made to run overhead cables; but he felt sure the Council would not allow any such disfigurement of their town. In the event of the Council seriously considering the erection and equipment of electrical works, they should get the best available electrical engineer to advise them, and they should not, because of the possible installation of electricity, cripple or starve the gas-works. There would be room for both. Mr. Thomas May, electrical engineer, of Londonderry, in his report, said that, assuming an overhead system, producer gas-engines, and direct-current two-wire supply, the capital cost, allowing for two engines of 100 H.P. each and two 75 K.W. dynamos, would be £5200. He pointed to "the increased comfort, cleanliness, and agreeableness in quality of light which would be placed at the disposal of the ratepayers," and also to the fact that "the introduction of electricity into a town advanced it in the scale of history by about fifty years in the estimation of the outside world."

Coventry Water Undertaking.—A successful year's working is shown by the accounts of the Coventry Water-Works for the year ended March 31 last. There is an available surplus of £8160. The Water Committee are recommending to the Town Council that £5000 be paid over in aid of the rates, that £2200 be paid to a suspense account towards meeting the cost of certain constructional works, that £576 be applied in meeting the final instalment of the cost of promoting the local Act of 1913, and that the balance of £386 be carried forward.

An Electrical Fusing.—Anxiety was caused during the evening of Monday of last week by an outbreak of fire on the premises of Messrs. Christie, in King Street, St. James's; and, in view of the valuable contents of the sale-rooms, large detachments of the London Fire Brigade hastened to the scene. It took some time to locate the trouble, which was eventually found to have originated through a fusing in connection with an electric motor near the roof which was used to work the lift. The smoke travelled down the shaft, and issued from the basement. The damage was entirely confined to the motor itself.

The 'ECLIPSE'—the most compact and efficient Hot Water Apparatus.



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Satisfactory Working at Newton-in-Makerfield.

Considerable all-round progress is revealed by the report for the year ended March last of the working of the Newton-in-Makerfield Urban District Council gas undertaking. It is signed by Mr. E. L. Bent (the Chairman of the Gas Committee) and Mr. Richard T. Surtees (the Engineer and Manager). In spite of the increased cost of coal, and with coke a falling market, an increase is shown in the net profit from £1331 last year to £2209 on the present occasion—a gain of (say) 65·96 per cent. The make of gas, at 121½ million cubic feet, shows an increase of 6·64 per cent. on the previous year's make; while the quantity sold (101 millions) was 8·4 per cent. more. The make of 12,101 cubic feet per ton of coal carbonized compares with 11,865 feet last year and 10,821 feet two years ago. This excellent result has, it is stated, been achieved by maintaining steadier heats, more uniform working, and strict attention to waste during the process of treating the gas through the works. There are in use by the consumers 2308 prepayment meters and 1525 ordinary ones. The percentage of unaccounted-for gas, though still, for various reasons, high, shows a reduction upon the figure for the preceding twelve months. For some years, the net price of gas to ordinary consumers has been 2s. 4d. per 1000 cubic feet; consumers of more than 1 million feet paying 2s. 3d., and more than 2 millions 2s. 2d. For prepayment meters the charge is 2s. 11d. per 1000 feet.

New Water-Works for Bettws-y-Coed.—Bettws-y-Coed has been put in possession of a new water supply by the recent formal opening of works which have cost £15,000. The water comes from Llyn Elsi, the rights in which have been presented to the Urban District Council by Lord Ancaster, by whom the inaugural ceremony was performed. The lake has an area of 28 acres; and, to increase the storage capacity, its level is to be raised by means of three dams which have been constructed—two at the end nearest the Lledr Valley, and the third, and largest, at the opposite end across the outlet from the lake into the valley of the Llugwy.

Fire at the Davis Company's Camberwell Works.—A fire broke out at the works of the Davis Gas-Stove Company, Limited, at Camberwell, on Tuesday, the 30th ult., about 12.45 p.m., just before the bell rang for the workmen's dinner hour. The outbreak, however, was confined to the polishing and grinding shop. It is not possible to define the actual cause; but it is surmised it was brought about by a spark from an emery wheel being drawn through the exhaust box and setting light to the woodwork. Prompt action on the part of the Company's employees, and also the fire brigade, who were telephoned for immediately, prevented the fire extending to other parts of the works. Although a large portion of the plant was destroyed by the fire and damaged by water, immediate steps were taken to put the department in working order, so that no delay in the delivery of goods passing through this part of the works is likely to take place.

An Inspector and Municipal Trading Profits.

In the course of a Local Government Board inquiry last Tuesday, regarding an application by the Manchester Corporation for power to borrow £68,000 for the purposes of the electrical undertaking, the Inspector (Mr. H. R. Hooper) suggested that motors for hiring-out might be provided out of revenue, instead of borrowing money for them on which interest had to be paid. Mr. W. T. Dagnall (the Chairman of the Electricity Committee) remarked that he did not see how they could pay for the motors out of revenue, and still hand over their contribution in aid of the rates. In closing the inquiry, the Inspector said that even in Manchester the electrical industry was as yet in its infancy. There had been no industry in which in the last few years there had been such enormous changes—in which so much plant put in to-day was "scrapped" to-morrow. Large units were the coming rule; for small ones were no good. In no other industry were there such enormous changes due to improvements and the rapid antiquation of plant; and if anything could be drawn from these lessons, he knew of no undertaking to-day which could contribute to the relief of rates—for the money was needed for the undertaking. It was not a parochial matter of relief of rates, but one which should benefit the whole community, and help the country to get cheap power, and consequently more trade. Manchester could not afford to pay one penny in relief of rates, if they only looked into the matter. Mr. Dagnall said they had tried to get the City Council to take this point of view, but they would not do it. The Inspector replied that this was the unfortunate way in which municipal undertakings were handicapped. They could not afford to pay this money in relief of rates, because it was required to keep pace with the tremendous progress of the movement from day to day.

Needham Market Gas Light Company, Limited.—A Company bearing the title of the Needham Market Gas Light Company, Limited, has been registered, with a capital of £2000, in £10 shares.

Kendal Gas and Water Undertakings.—The annual reports of the Kendal gas and water undertakings were presented by Alderman Monkhouse at last Wednesday's meeting of the Town Council. The report of the Gas Department showed the gross profit for the year was £3599, and after meeting all charges there remained a surplus of £772. The surplus last year was £818; and it would have been greater this year but for the higher price of coal, extra wages, repairs, and other items. The average price realized for gas was 2s. 7·74d. per 1000 cubic feet. In the Water Department the gross receipts amounted to £3945, and there was a balance after meeting all charges of £93. The Engineer and Manager (Mr. W. R. Wilson) states that the total quantity of gas made was 96,726,500 cubic feet, or 2·84 per cent. more than in the preceding year. The amount registered by the consumers' meters was 91,841,500 feet, which was an increase of 3·33 per cent. At March last the number of consumers was greater by 23 than at the end of the previous financial period.

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Conway Gas-Works Litigation.—In connection with a recommendation of the Gas and Lighting Committee that a cheque for £473 be paid to the Council's Solicitor, to enable him to settle a number of expert witnesses' and Counsel's fees for the recent appeal in the case of *Wood v. Corporation of Conway*, some discussion took place at the last meeting of the Conway Town Council. The Town Clerk remarked that some of the expert witnesses were asking fabulous fees, and the Solicitor recommended in certain cases reducing the amounts, and leaving it to the witnesses to sue the Council for the balance. The Committee's suggestion was agreed to.

Bursting of Submerged Water Pipes.—The members of the Conway and Colwyn Bay Joint Water Supply Board consulted with their Engineer (Mr. T. B. Harrington) last Friday with reference to the methods of repairing the two pipes which recently burst under the bed of the Conway near Dolgarrog. The new main, 15 inches in diameter, which is essential to the adequate supply of the district, is laid in duplicate in the river bed at the point named, and both pipes burst nearly simultaneously. Fortunately, the Board had just concluded a friendly agreement with the Llandudno Urban District Council for an emergency supply of water, and this was at once secured. With the aid of divers, Mr. Harrington reported, a patch was put on one of the mains, which enabled a full and sufficient supply to be maintained throughout the district. A cofferdam was being constructed under the second main, and when it was ready the other pipe would be repaired. Trial borings would then be made to ascertain the nature of the ground at each side of the river, with a view to the Board considering whether it would not be advisable to erect a bridge to carry the pipes. The Engineer added that he would not care again to go through the experience of the past six weeks, and would not willingly undertake another river crossing unless he could have a bridge or a culvert.

Additional Capital for the Houghton-le-Spring Gas Company.—It will be seen from an announcement which appears elsewhere that the Houghton-le-Spring Gas Company are inviting tenders for 500 preference shares of £10 each (the minimum price of issue), entitled to a dividend of 6 per cent., under the provisions of their Act of 1912. The present management took over the concern on Jan. 1, 1910, since which date the business has developed, and is capable of much extension. The works have been remodelled by Messrs. Corbet Woodall and Son, who now supervise the undertaking as Consulting Engineers.

Wolverhampton Water Supply.—The Water Committee of the Wolverhampton Corporation report that, after payment of the interest and sinking fund on borrowed capital, the profit on the past year's account amounts to £4772. Out of this, the sum of £69 for additions to meters has been met; reducing the available profit for the year to £4703. The Council at their meeting in March last decided to appropriate £4251, equal to a rate of about 3d. in the pound, in aid of the improvement rate for the year ending March 31, 1915. The balance of £452 has been added to the reserve fund, which now stands at £18,217.

The Darwen Corporation have decided to increase the wages of their meter inspectors from 28s. to 30s. per week, and of gas-fitters from 6½d. to 7d. per hour.

The Troon Town Council have decided to instal the "A. & M." patent automatic lighting and extinguishing apparatus, together with Messrs. Alder and Mackay's hurricane-proof copper lanterns to the number of 250.

The Bradford Corporation Gas Committee have fixed, as the annual charge for high-pressure lighting, £4 per lamp, inclusive of the supply, fixing, and maintenance of the lamp, and the gas consumed—subject to a three years' agreement being entered into by hirers.

GAS COMPANIES IN THE STOCK EXCHANGE.

In the Stock Exchange last week markets suffered most from inanition. Their tone fluctuated from time to time, according as hopes and fears alternately prevailed regarding home and foreign politics. In the former, the week has produced but little definite; but in the latter, the astonishing success of the French loan was a good point. The fortnightly account was a fairly heavy one; but the settlement appears to have been adjusted without catastrophe. Markets presented an irregular array of gains and losses at the close; one noteworthy feature being the fact that Home Government issues were all higher except Consols, which receded ¼ in the week. The opening showed a very good tendency—mostly on cheap money and sanguine forecasts of an Ulster settlement. Gilt-edged things took the lead, and set a brave example, Consols rising ⅜. Rails were more active and buoyant, Wall Street prices supported Transatlantics, and Foreign had good spots. Tuesday drew in rather, with slack business and some amount of profit-taking; so that Consols fell ⅛ for money and ¼ for the account. Other leading markets were rather drooping; but buyers supported Rails. Wednesday was very quiet, having the settlement in hand. Movements were uneven. Consols receded another ⅛; but the rest of the leading departments in general were steady. Thursday opened with some promise; but it did not last, and markets which had been firm the day before were now the weakest. Rails suffered from decay, Americans were weak, but Consols were unchanged. Friday was quite weak, influenced by the latest aspect of home and foreign affairs and the hardening of money. Consols were put down another ¼. Saturday was almost a *dies non*—quiet even for a summer Saturday. Some markets remained fairly steady; but Consols were weak again—touching 75⅛ at the close, with a quotation of 75⅛ to 75¼. In the Money Market, rates steadily hardened and closed firm. Business in the Gas Market was no better than moderate in point of volume; and by far the largest part of that was confined to the three biggest issues. But everything without exception was very firm. Quotations which moved at all moved upwards; and more would doubtless have done the like if they had had the chance of a transaction or two. In Gas Light and Coke issues, the ordinary was pretty brisk and still rising; all dealings being between 102⅞ and 104—a rise of ½. In the secured issues, the maximum realized 79, the preference 97⅜, and the debenture 73. South Metropolitan was more active, and changed hands at 111 to 112½—a rise of 1. The debenture marked 75⅛ *cum div.* In Commercials, the 4 per cent. was done at 106½, and the 3½ per cent. at 104 and 104½. Among the Suburban and Provincial Group, Alliance and Dublin fetched 61, Brighton "A" 157½ (a rise of 1), British 44¾, Southampton 100 and 100½, and Tottenham "B" 116½. In the Continental companies, Imperial marked 163½ to 166 (a rise of 1), and European 18¼ and 18 7/16. Among the undertakings of the remoter world, Cape Town debenture was done at 71, Primitiva at 5⅜, ditto preference at 4⅞ and 4 15/16, and ditto debenture at 92.

OFFICIAL QUOTATIONS AT THE CLOSE OF THE WEEK.

Bank Rate (fixed January 29), 3 per cent. Last year, 4½ per cent. Consols, 75¼—75½. Previous week, 75⅛—75⅜.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	61—66	..	3 15 9
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79*	..	5 1 3
280,000	5	April 29	7½	Bombay, Ltd.	5⅛—6⅜	..	5 17 8
50,000	10	Feb. 26	16	Bournemouth and Water — 10 p.c.	29—30	..	5 6 8
862,500	10	,,	7	Bournemouth and Water — B 7 p.c.	15—15½	..	4 10 4
75,000	10	,,	6	Bournemouth and Water — Pref. 6 p.c.	13½—14	..	4 5 9
880,000	Stk.	Feb. 26	14	Brentford Consolidated	260—265	..	5 5 8
830,000	,,	,,	11	Do. New	204—209	..	5 5 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	..	4 10 1
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	+1	5 8 4
244,300	,,	,,	8	Do. A Ord. Stk.	154—159	+1	5 0 8
530,000	20	Mar. 26	12½	British	44—45	..	5 11 1
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	..	4 8 11
345,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	87—89	..	4 9 11
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	..	—
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	..	6 0 0
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	108—110	..	4 10 11
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	..	4 8 11
800,000	Stk.	,,	4	Continental Union, Ltd.	78—81	..	4 18 9
200,000	,,	,,	7	Do. 7 p.c. Pref.	113½—116½	..	6 0 2
492,270	Stk.	,,	7	Derby Con. Stk.	125—125	..	4 16 0
55,000	,,	—	6	Do. Deb. Stk.	102—104	..	5 16 11
1,002,180	,,	Jan. 15	4	Do. Deb. Stk.	102—104	..	3 16 11
16,386,660	Stk.	Feb. 12	10	European, Ltd.	18—18½	..	5 8 1
2,600,000	,,	,,	4/17/4	Gas — 4 p.c. Ord.	102½—104½	+½	4 18 2
4,062,235	,,	,,	8½	Gas — 8½ p.c. max.	76—79	..	4 8 7
4,674,850	,,	,,	4	Gas — 4 p.c. Con. Pref.	96—99	..	4 0 10
258,740	Stk.	June 11	8	Gas — 8 p.c. Con. Deb.	72½—74½	..	4 0 6
70,000	10	Mar. 12	5	Hastings & St. L. 8½ p.c.	87—89	..	5 12 4
131,000	Stk.	April 29	11	Hongkong & China, Ltd.	16¼—16¾	..	6 11 4
65,790	,,	Mar. 12	7½	Ilford A and C	151—154	..	4 19 0
65,500	,,	,,	6½	Do. B	115—118	..	5 3 10
4,940,000	Stk.	June 26	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
1,285,000	Stk.	May 14	9	Imperial Continental	162—167	+1	5 7 9
200,342	Stk.	Feb. 12	8½	Do. 3½ p.c. Deb. Red.	84—86	..	4 1 5
561,000	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	..	5 7 5
718,100	,,	Feb. 26	10	Liverpool United A	210—212	..	4 14 4
306,083	,,	,,	7	Do. B	144—146	..	4 15 11
	,,	June 26	4	Do. Deb. Stk.	97—99	..	4 0 10

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
75,000	5	June 11	6	Malta & Mediterranean	4½—4⅝	..	6 9 9
250,000	100	April 1	4½	Met. of Melbourne — 4½ p.c. Deb.	99—101	..	4 9 1
541,930	20	May 28	4	Monte Video, Ltd.	11⅝—12½	..	6 13 1
1,775,892	Stk.	Feb. 26	4½	Newo'tle&G'tesh'd Con.	£9½—100½	..	4 9 7
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	£2—83	..	4 4 4
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	..	5 2 8
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122	..	6 11 2
60,000	5	Mar. 26	10	Ottoman, Ltd.	7⅛—7⅜	..	6 9 0
60,000	50	Feb. 26	13	Portsea, Island B	128—131	..	4 19 3
100,000	50	,,	12	Do. C	118—121	..	4 19 2
249,980	5	April 29	8	Primitiva Ord.	5⅜—6¼	..	6 8 0
499,960	5	June 26	5	,, 5 p.c. Pref.	4¾—5⅛	..	4 17 7
521,600	100	June 2	4	,, 4 p.c. Deb.	91—93	..	4 6 0
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	..	4 12 0
150,000	10	May 14	6	San Paulo — 6 p.c. Pref.	10½—11	..	5 9 1
125,000	50	July 1	5	San Paulo — 5 p.c. Deb.	47—49	..	5 2 0
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	..	4 9 3
209,984	,,	,,	10	Do. B	223—224	..	4 9 3
523,500	,,	,,	10	Do. C	220—222	..	4 10 1
90,000	10	May 28	9	South African	10½—11½	..	7 16 6
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111—113	+1	4 16 8
1,895,445	,,	July 10	8	Do. 3 p.c. Deb.	72¼—74¾*	..	4 0 6
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	..	5 6 11
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	..	5 3 5
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	..	4 9 3
117,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	..	4 4 9
629,740	Stk.	May 14	5	Southampton Ord.	99—102	..	4 18 0
120,000	Stk.	Feb. 12	7⅜ 5½	Tottenham District — A 5 p.c.	135—138	..	5 6 10
543,940	,,	,,		Tottenham District — B 3½ p.c.	115—117	..	5 0 5
149,470	,,	June 26	4	Tottenham District — 4 p.c. Deb.	87—89	..	4 9 11
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	..	8 6 8
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	..	5 5 3
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	..	4 11 4
30,000	Stk.	Feb. 26	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	..	5 7 4
255,636	,,	,,	6⅞	,, B 3½ p.c.	129—134	..	5 2 7
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110—115	..	5 2 0
352,000	,,	,,	6½	Wimbledon 5 p.c.	117—122	..	5 0 5
98,000	,,	,,	6⅜	Epsom 5 p.c.	121—126	..	5 5 2
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	..	4 6 11

Prices marked * are "Ex Div."

In a communication to the East Cowes Rural Council, the Local Government Board intimate that the application for a loan of £1000, to provide additional pumping power from the wells which furnish the public supply, must be deferred until the experiments at the new "Burnt House" site are completed, and the reports received as to the probable yield of water from that source, which might cause a discontinuance of the existing wells. The Surveyor has meanwhile placed on record the fact that there are continuing complaints as to the water; the higher districts affirming that the supply is insufficient, while the lower districts state that the water is received in a dirty condition.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS AND WATER ENGINEER. Rhymney and Aber Valley Gas and Water Company. Applications by July 18.
ASSISTANT ENGINEER AND MANAGER. Torquay Gas Company. Applications by July 25.
REPRESENTATIVE. Jas. Milne and Son, Limited, Leeds.
DISTRICT INSPECTOR. Aldershot Gas, Water, and District Lighting Company.
WORKS FOREMAN. Cleethorpes Gas-Works.
GAS FITTERS. No. 5911.

Appointments Wanted.

WORKING MANAGER. No. 5913.

Plant, &c. (Second Hand), For Sale.

SATURATOR, &c. Yorkshire Semet-Solvay Company, Sheffield.

Plant, &c. (Second Hand), Wanted.

GASHOLDER. Hall Motor Fuel, Limited, Edmonton.

Journal Volumes For Sale. No. 5912.

Gas-Works Wanted.

"D. G.," c/o Scripps's Advertising Offices.

Sales of Shares.

HOUGHTON-LE-SPRING GAS COMPANY. By Tender. July 21.

Meetings.

TOTTENHAM LIGHT, HEAT, AND POWER COMPANY. Gas-Works, Tottenham. Aug. 8. Three o'clock.

Patent Licences.

METER. George Barker and Brettell, Birmingham.
PURIFYING GAS. Lloyd Wise and Co., 10, New Court, Lincoln's Inn, W.C.

TENDERS FOR

Coal.

BAKEWELL URBAN DISTRICT COUNCIL. Tenders by July 31.
BUXTON GAS DEPARTMENT. Tenders by July 25.
CLACTON URBAN DISTRICT COUNCIL. Tenders by Aug. 5.

Coal *(continued)*.

FARNHAM GAS AND ELECTRICITY COMPANY. Tenders by July 22.
HAWORTH URBAN DISTRICT COUNCIL. Tenders by July 24.

Gasholder.

CARDIFF GAS COMPANY. Tenders by July 22.

General Stores.

SALFORD GAS DEPARTMENT.

Oxide.

SALFORD GAS DEPARTMENT.

Tar.

BUXTON GAS DEPARTMENT. Tenders by July 25.
MALVERN URBAN DISTRICT COUNCIL. Tenders by July 20.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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